

**SAMS**

CSCS12 08974

# COMPUTERFACTS™

TECHNICAL SERVICE DATA

ATARI®  
MODEL 520ST  
COMPUTER



FEATURES: COMPLETE SCHEMATICS • PRELIMINARY SERVICE CHECKS • TROUBLESHOOTING TIPS •  
EASY-READ WAVEFORMS • REPLACEMENT PARTS LISTS • SEMICONDUCTOR CROSS-REFERENCE





**SAMS****COMPUTERFACTS™****ATARI  
MODEL 520ST****DISK DRIVE**

See Folder CSCS12-A

**MONITOR**

See Folder CSCS12-B

**KEYBOARD, POWER SUPPLY,  
SYSTEM BOARD****ATARI  
MODEL 520ST****CSCS12****CSCS12****ATARI  
MODEL 520ST****PRELIMINARY SERVICE CHECKS**

ENCLOSED

**SAFETY PRECAUTIONS**

See page 17.

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**SAMS™****Howard W. Sams & Co.**

4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

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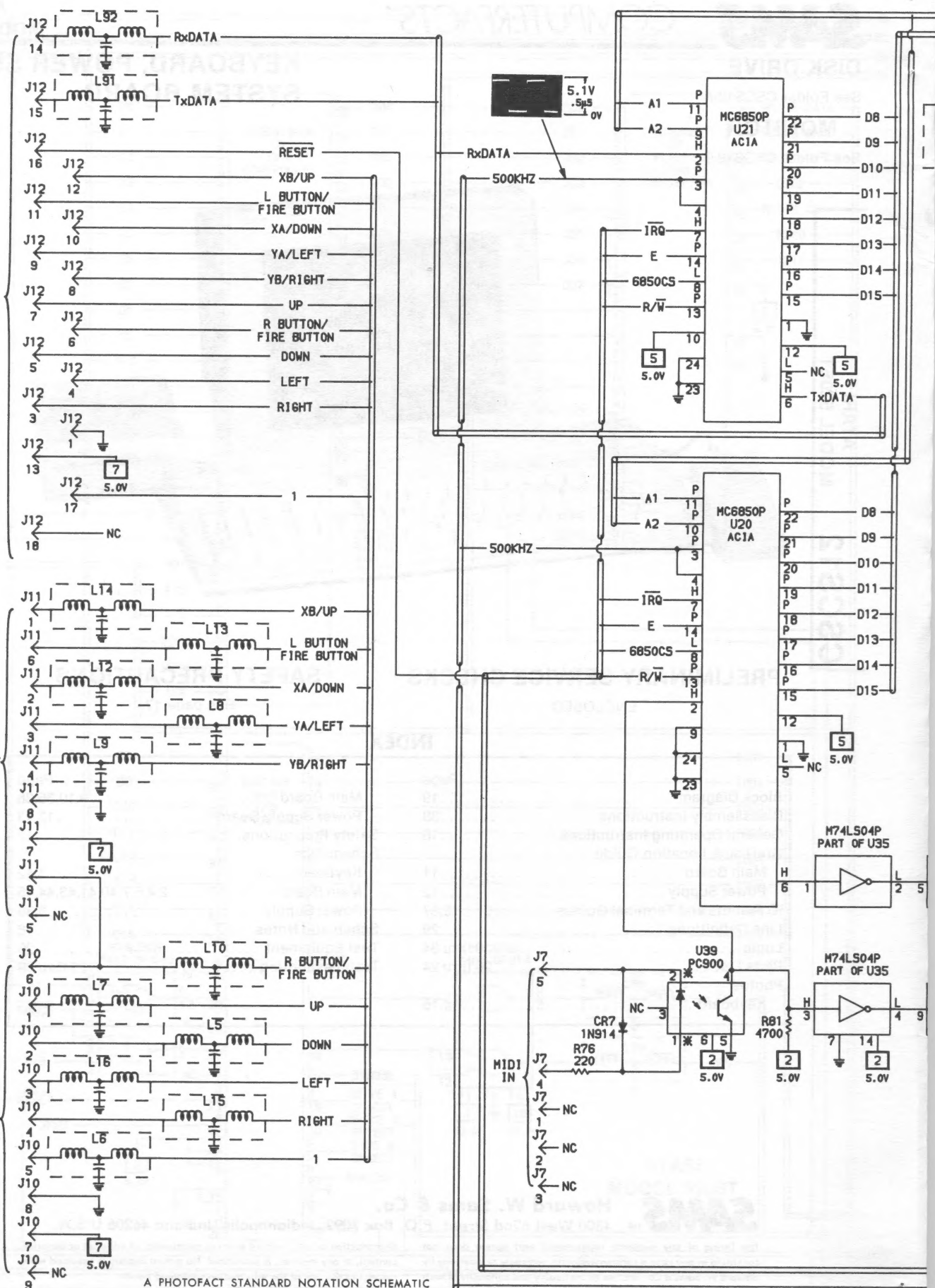
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SEE  
KEYBOARD  
PAGE 42

TO  
MOUSE/  
JOY 0

TO  
JOY 1



A PHOTOFAC STANDARD NOTATION SCHEMATIC

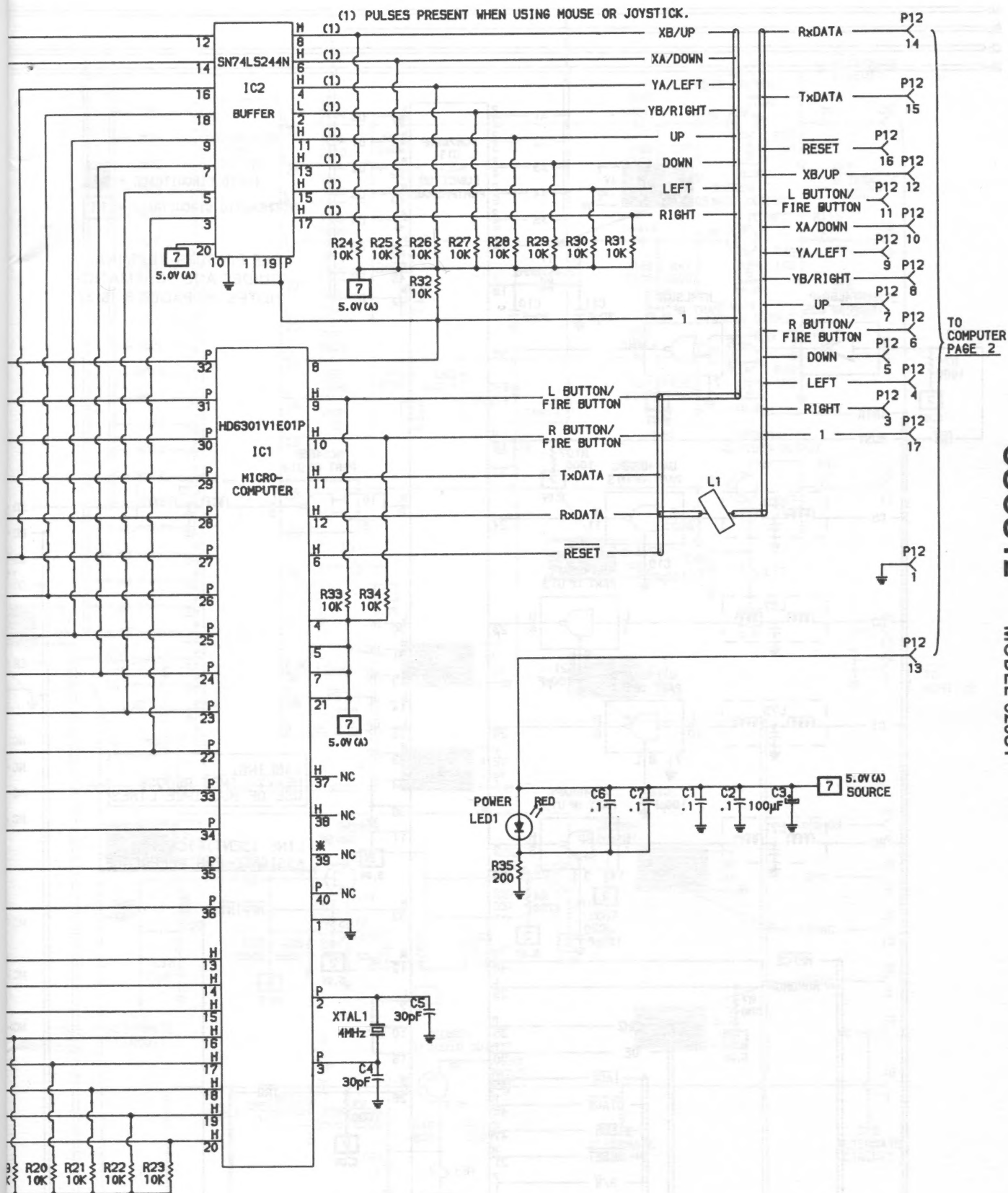
WITH **CIRCUITRACE™**

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# CSCS12

## ATARI MODEL 520ST



CIRCUITRACE = 11

CIRCUITRACE = 11

SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES ON PAGES 8, 18, 37

CABLING, HEAVY LINES REDUCE USE OF MULTIPLE LINES

A PHOTOFACIT STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE

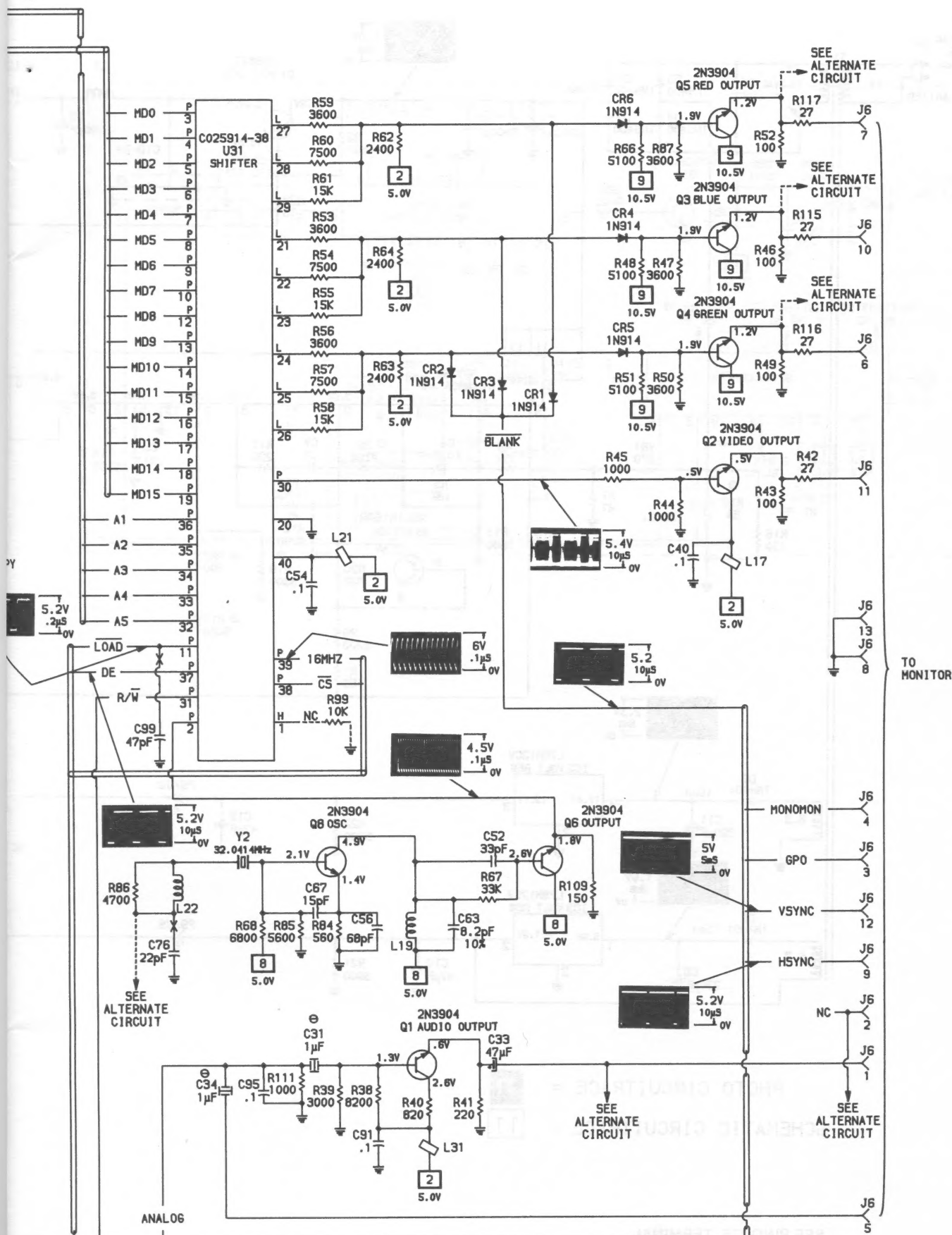
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KEYBOARD





# CSCS12 ATARI MODEL 520ST



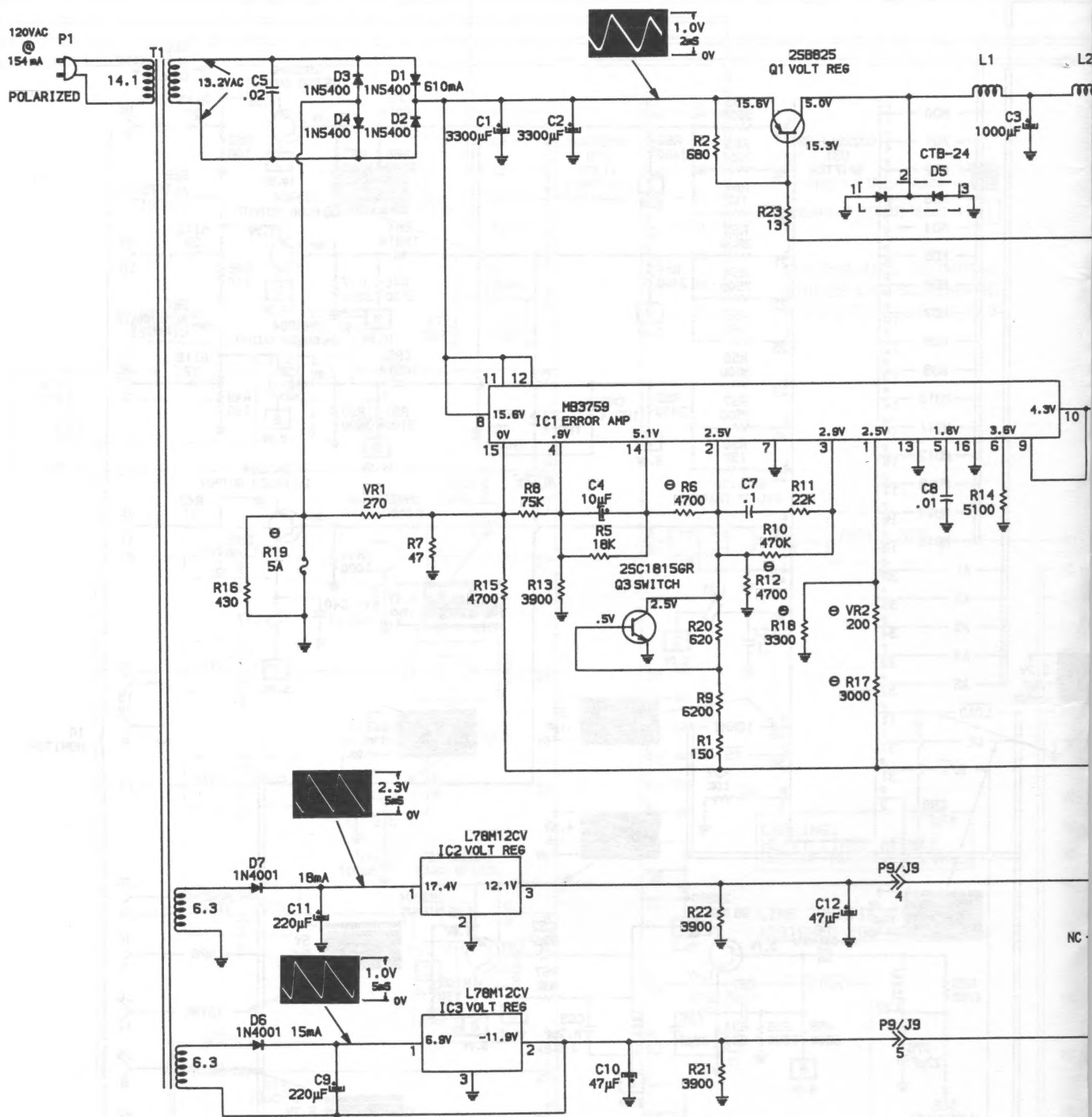


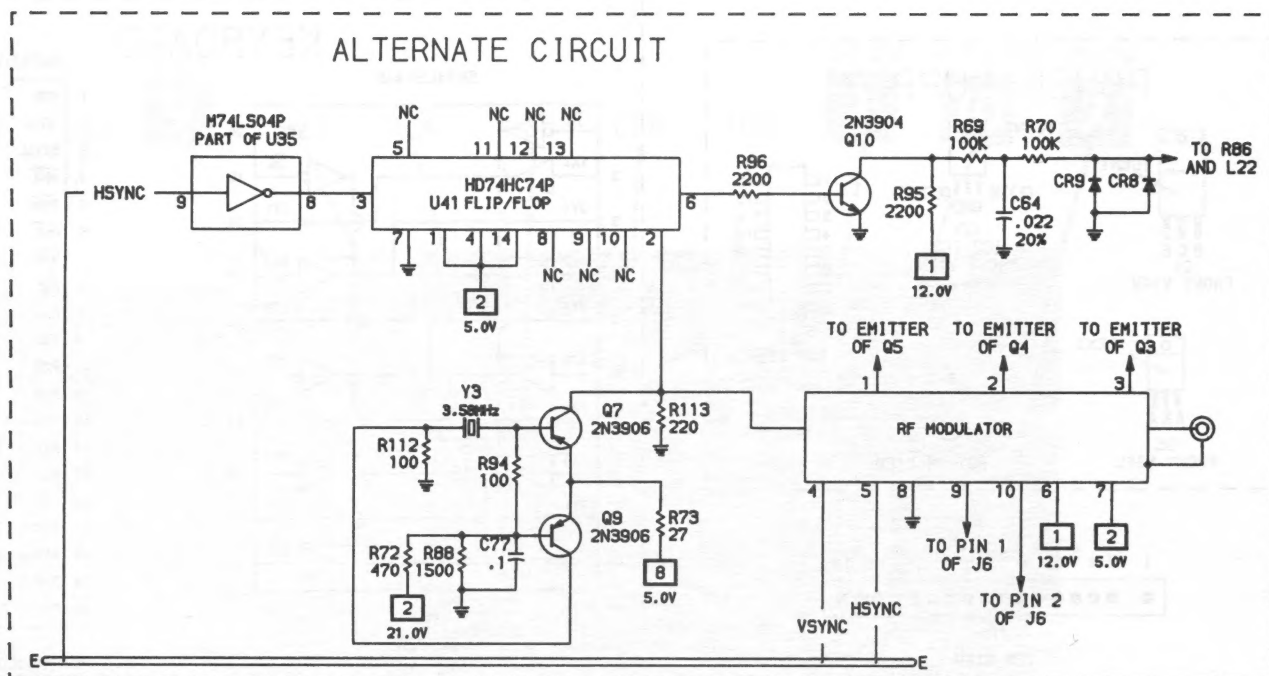
PHOTO CIRCUITRACE = 11

SCHEMATIC CIRCUITRACE = 11

SEE PINOUTS, TERMINAL  
GUIDES AND SCHEMATIC  
NOTES ON PAGES 8, 18, 37

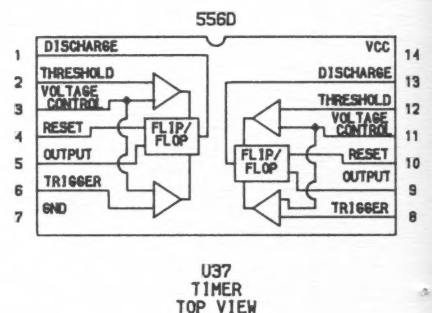
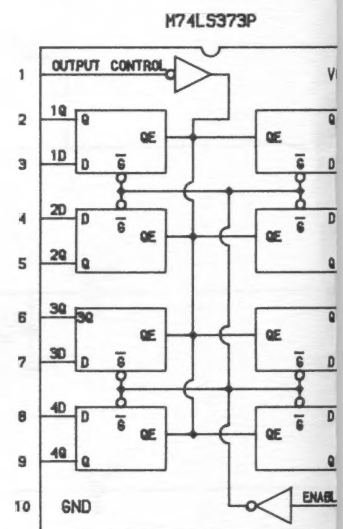
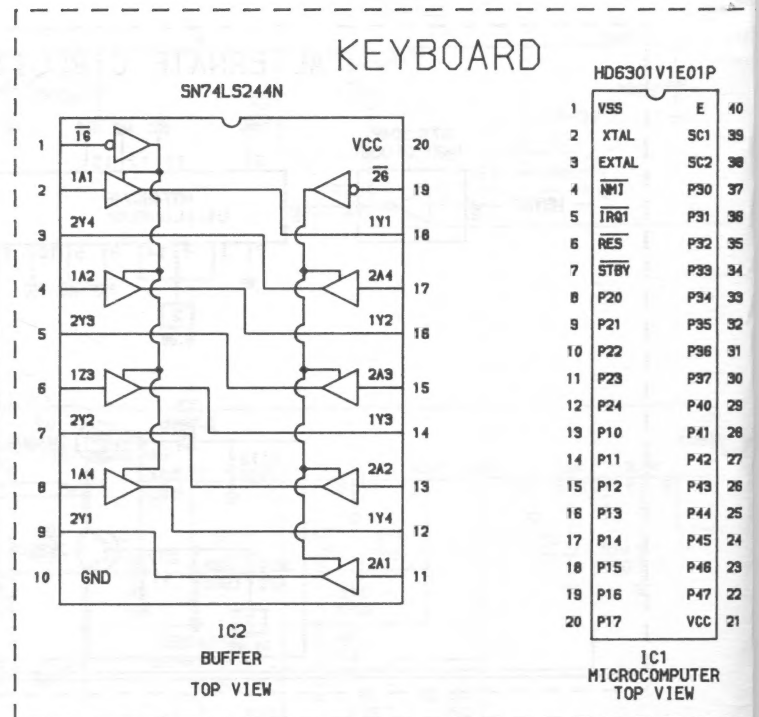
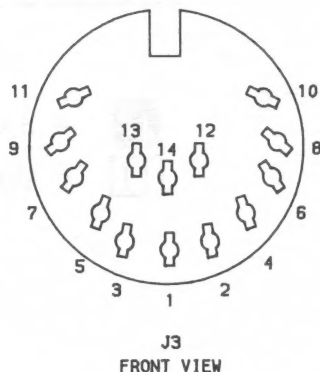
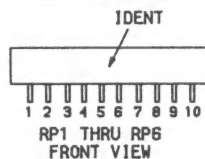
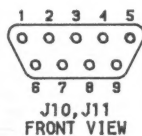
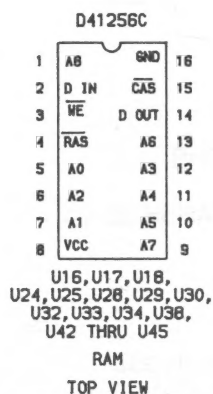
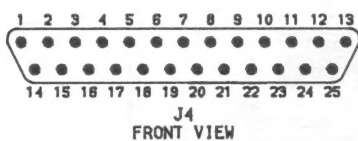
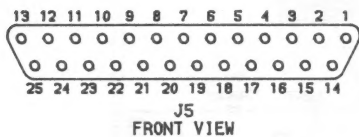
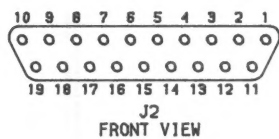
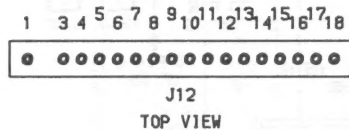
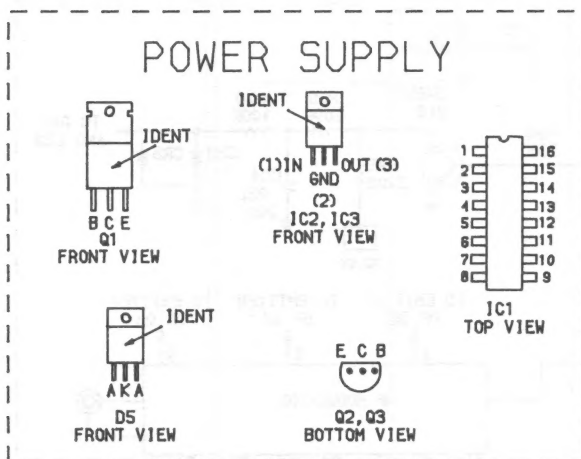
POWER SUPPLY





**CSCS12**

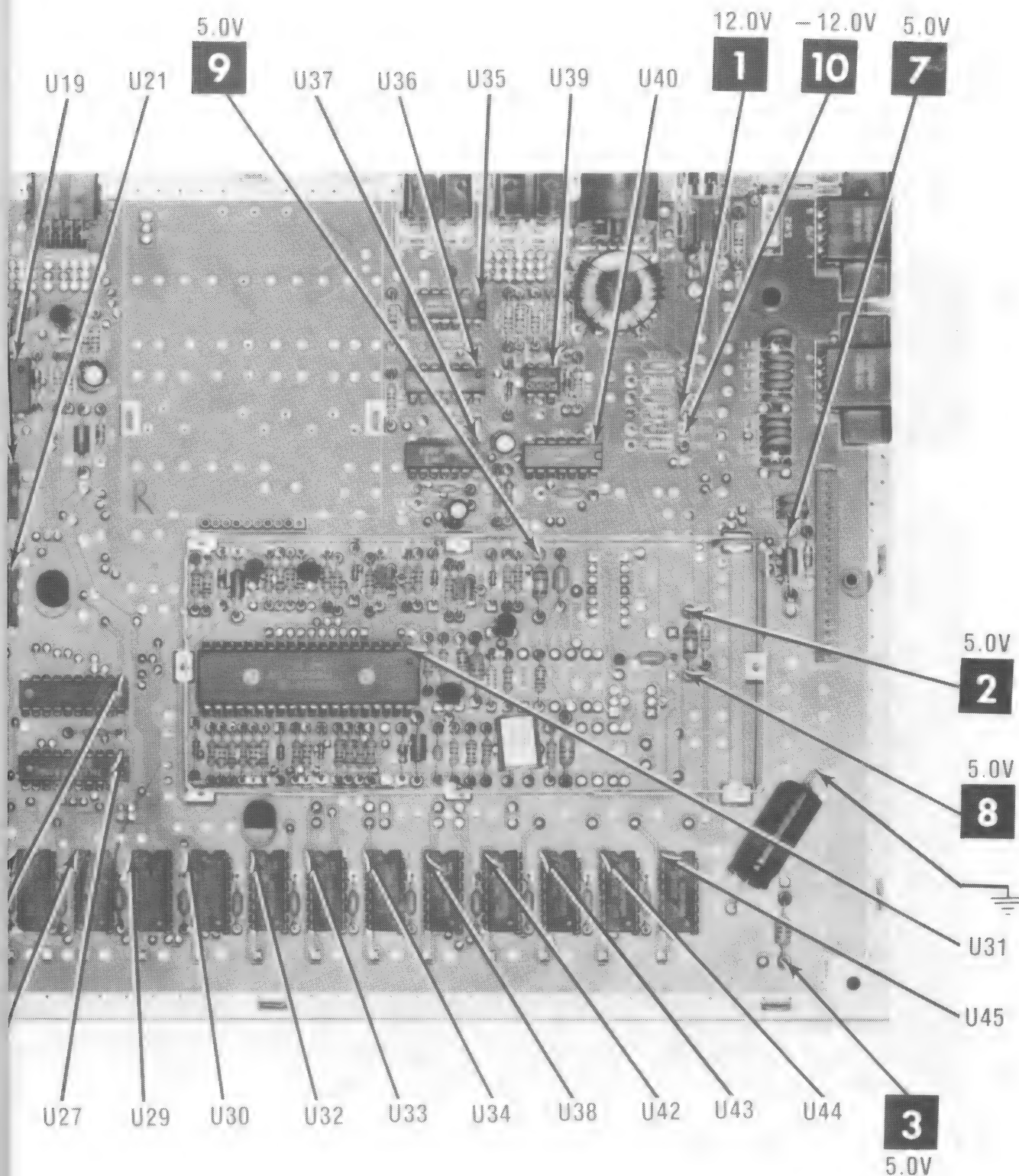
**ATARI  
MODEL 520ST**



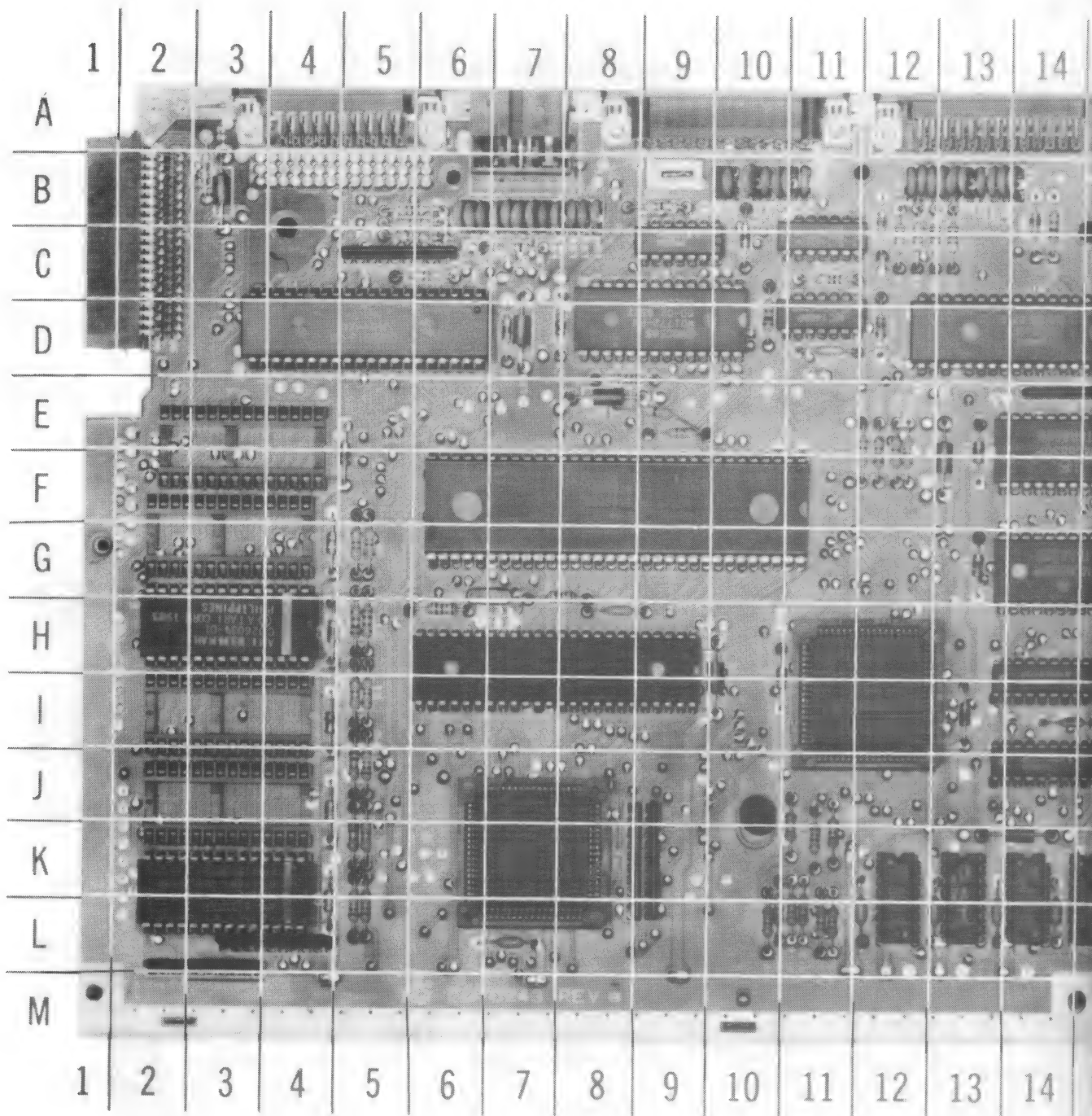


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MAIN BOARD





# MAIN BOARD GridTrace LOCATION GUIDE

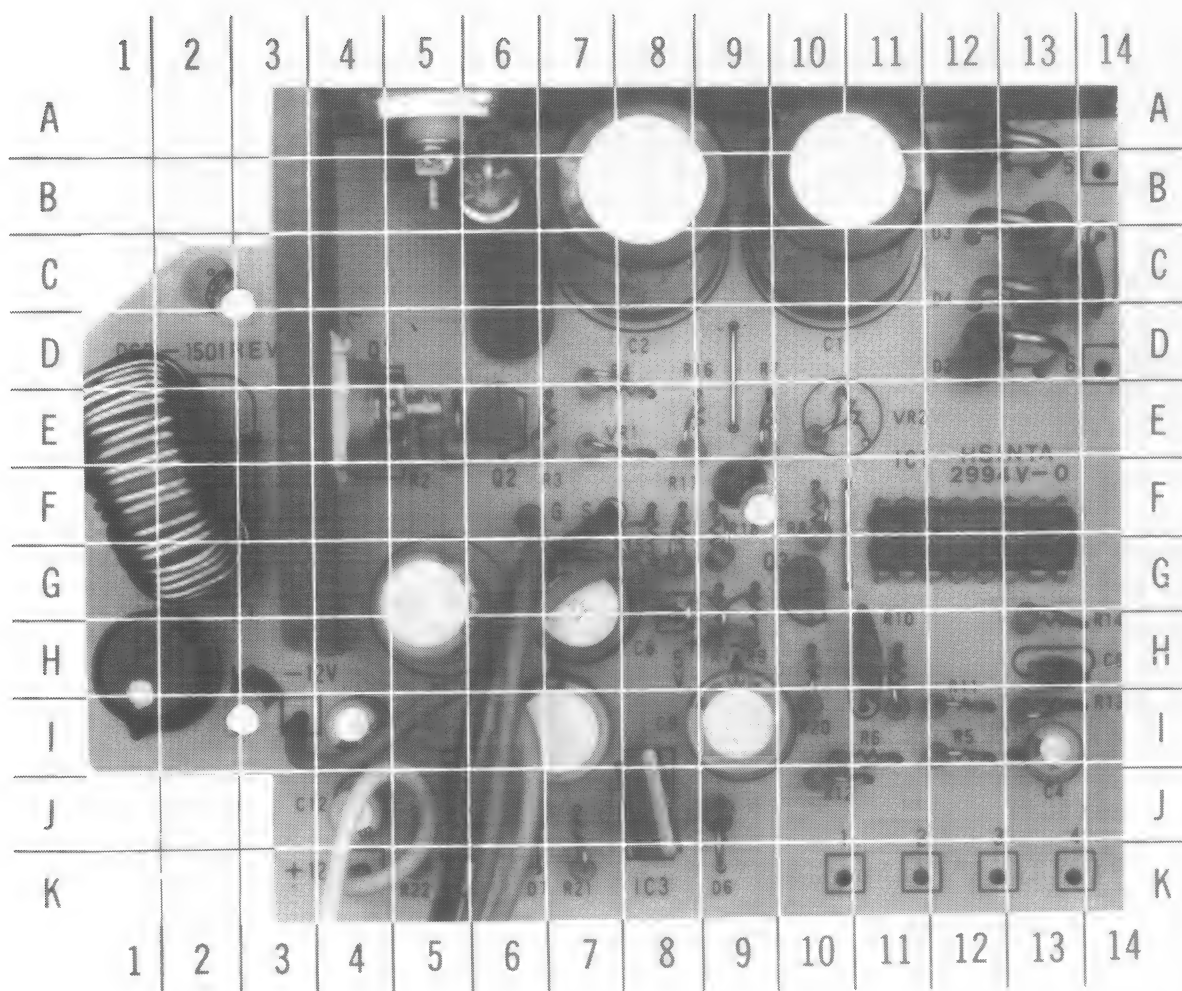
C1	F-5	C101	E-25	L79	B-13	R85	I-22
C2	G-4	C102	D-25	L80	B-13	R86	I-23
C3	H-4	C103	D-25	L81	B-13	R87	G-23
C4	I-4	C104	J-27	L82	B-13	R93	B-26
C5	J-4	CR1	I-20	L83	B-14	R100	B-9
C6	L-4	CR2	I-19	L91	E-27	R101	C-7
C7	D-7	CR3	I-18	L92	F-27	R102	C-6
C8	D-7	CR4	G-20	Q1	C-16	R103	B-5
C9	E-9	CR5	G-22	Q2	G-19	R105	K-5
C10	H-6	CR6	G-23	Q3	G-20	R107	C-11
C11	G-7	CR7	D-23	Q4	G-21	R109	H-22
C12	H-8	J1	C-2	Q5	G-22	R111	B-14
C13	L-7	J2	A-4	Q6	G-23	R115	G-19
C14	C-10	J3	A-7	Q8	H-22	R116	G-21
C15	D-12	J4	A-10	R1	G-5	R117	G-22
C16	H-10	J5	A-13	R2	G-5	R118	L-11
C17	B-12	J6	A-16	R3	H-5	R119	J-11
C18	C-12	J7	A-22	R4	I-5	R120	L-11
C19	C-12	J8	A-23	R5	H-5	R121	L-10
C20	C-13	J9	A-25	R6	I-5	R122	L-11
C21	C-12	J10	A-28	R7	J-5	R123	L-10
C22	D-11	J11	D-28	R9	L-5	R124	K-11
C23	E-13	J12	F-28	R10	J-5	R125	K-11
C24	G-13	L3	B-24	R11	K-5	R126	L-11
C25	I-13	L5	D-27	R12	L-5	RP1	L-3
C26	L-12	L6	C-27	R13	C-5	RP2	L-3
C27	L-13	L7	D-27	R14	D-10	RP3	C-5
C28	L-13	L8	D-27	R15	B-5	RP4	K-9
C29	I-14	L9	D-27	R16	D-8	RP5	K-9
C30	L-14	L10	D-27	R29	E-12	RP6	E-14
C31	C-15	L12	D-27	R30	E-12	SW1	A-26
C32	D-16	L13	E-27	R31	E-12	SW2	A-27
C33	D-16	L14	E-27	R32	E-12	U1	D-5
C34	C-15	L15	C-27	R38	D-16	U4	H-3
C35	I-16	L16	C-27	R39	C-16	U7	K-3
C36	L-15	L17	G-19	R40	D-16	U8	C-9
C37	L-16	L18	G-23	R41	C-16	U9	D-9
C38	L-17	L19	H-22	R42	G-18	U10	F-8
C39	L-18	L20	H-26	R43	G-18	U11	H-7
C40	G-18	L21	I-21	R44	G-19	U12	K-7
C41	L-19	L22	I-24	R45	G-19	U13	C-11
C42	L-20	L23	B-3	R46	G-20	U14	D-11
C44	L-20	L24	D-7	R47	G-20	U15	I-12
C45	L-21	L25	E-8	R48	G-20	U16	K-12
C46	C-22	L26	H-10	R49	G-21	U17	K-13
C47	D-22	L27	E-13	R50	G-21	U18	K-14
C48	E-22	L28	K-14	R51	G-21	U19	D-14
C49	F-22	L29	L-27	R52	G-22	U20	E-14
C50	F-22	L30	F-27	R53	I-18	U21	G-14
C51	G-24	L31	E-16	R54	I-18	U22	H-14
C52	H-22	L55	B-6	R55	I-19	U23	J-14
C54	I-21	L56	B-6	R56	I-19	U24	K-15
C55	E-23	L57	B-6	R57	I-19	U25	K-16
C56	I-22	L58	B-7	R58	I-19	U26	H-16
C57	L-22	L59	B-7	R59	I-20	U27	J-16
C59	D-24	L60	B-7	R60	I-20	U28	K-17
C60	E-24	L61	B-7	R61	I-20	U29	K-17
C63	H-23	L62	B-7	R62	I-20	U30	K-18
C67	I-22	L63	B-7	R63	I-21	U31	H-20
C70	B-26	L64	B-7	R64	I-21	U32	K-19
C71	C-25	L65	B-7	R66	G-23	U33	K-20
C72	D-25	L66	B-7	R67	H-22	U34	K-21
C73	H-25	L67	B-10	R68	H-23	U35	C-22
C74	H-26	L68	B-10	R74	C-21	U36	D-22
C76	H-23	L69	B-10	R75	D-21	U37	E-22
C78	L-23	L70	B-10	R76	C-23	U38	K-22
C79	L-24	L71	B-10	R77	C-23	U39	D-23
C80	L-25	L72	B-10	R78	C-23	U40	E-24
C90	B-3	L73	B-11	R79	C-23	U42	K-23
C91	E-17	L74	B-12	R80	C-24	U43	K-24
C92	F-27	L75	B-12	R81	D-24	U44	K-24
C95	B-14	L76	B-12	R82	E-23	U45	K-25
C99*	H-19	L77	B-13	R83	E-23	Y1	G-7
C100	D-25	L78	B-13	R84	I-22	Y2	I-23

\* Located on bottom of board.

**CSCS12**  
ATARI  
MODEL 520ST

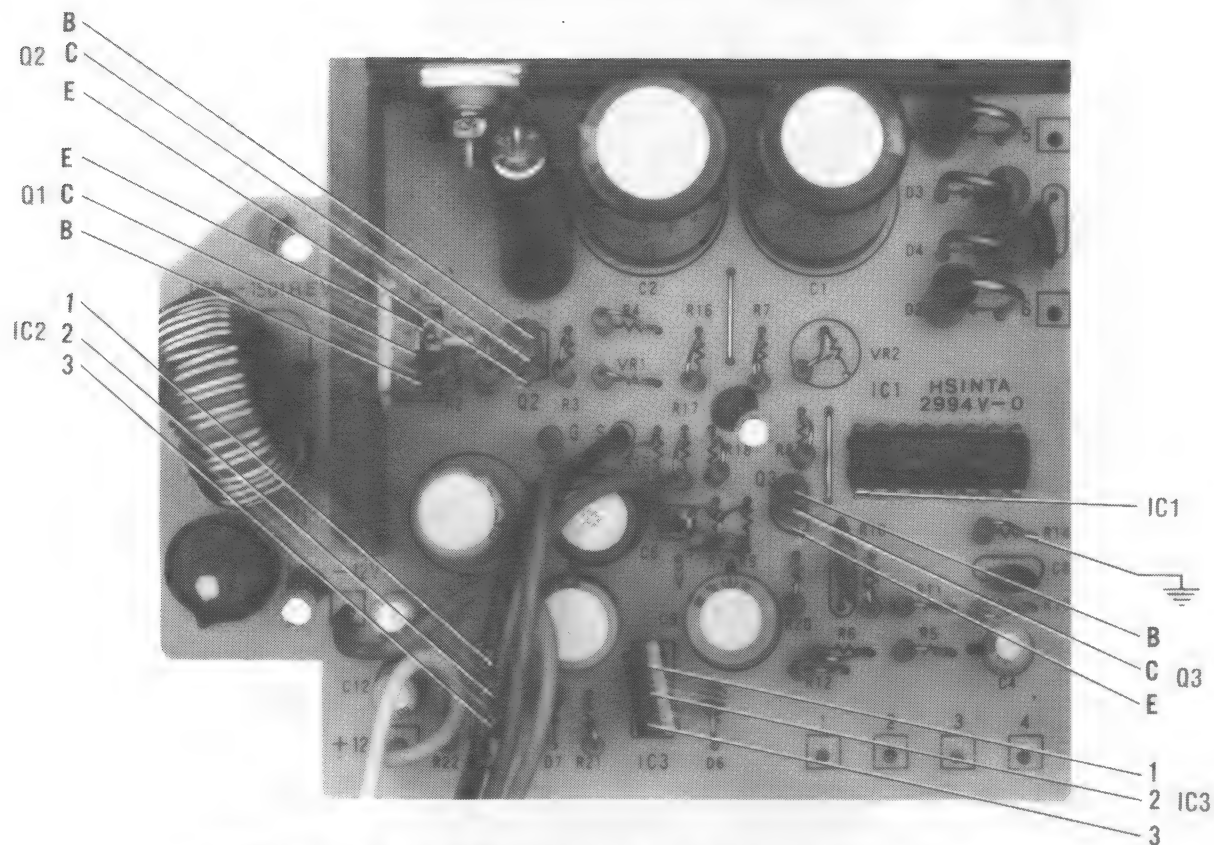
# GridTrace LOCATION GUIDE

C1	B-10	D7	J-6	R10	I-11
C2	B-8	IC1	G-12	R11	I-12
C3	G-5	IC2	J-5	R12	J-10
C4	I-13	IC3	J-8	R13	I-13
C5	C-14	L1	E-1	R14	H-13
C6	G-7	L2	H-1	R15	G-8
C7	H-11	Q1	E-4	R16	E-8
C8	H-13	Q2	E-6	R17	G-8
C9	I-9	Q3	G-10	R18	G-9
C10	I-4	R1	H-9	R19	B-6
C11	I-7	R2	E-5	R20	I-10
C12	J-4	R3	E-7	R21	K-7
D1	B-12	R4	D-7	R22	K-5
D2	D-12	R5	I-12	R23	E-5
D3	C-13	R6	I-10	VR1	E-7
D4	C-13	R7	E-9	VR2	E-10
D5	A-5	R8	F-10		
D6	J-9	R9	H-9		



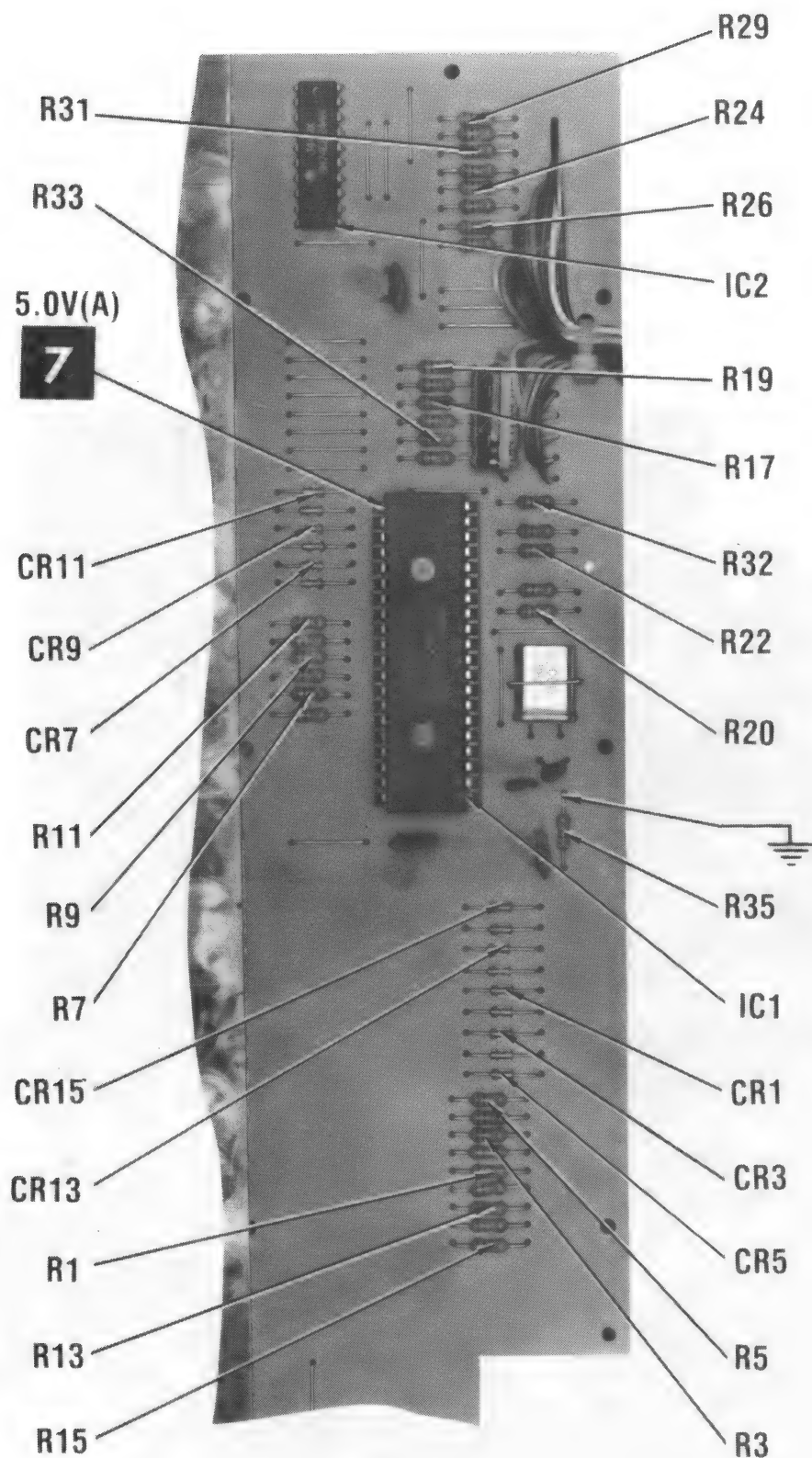
# CSCS12

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NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED.

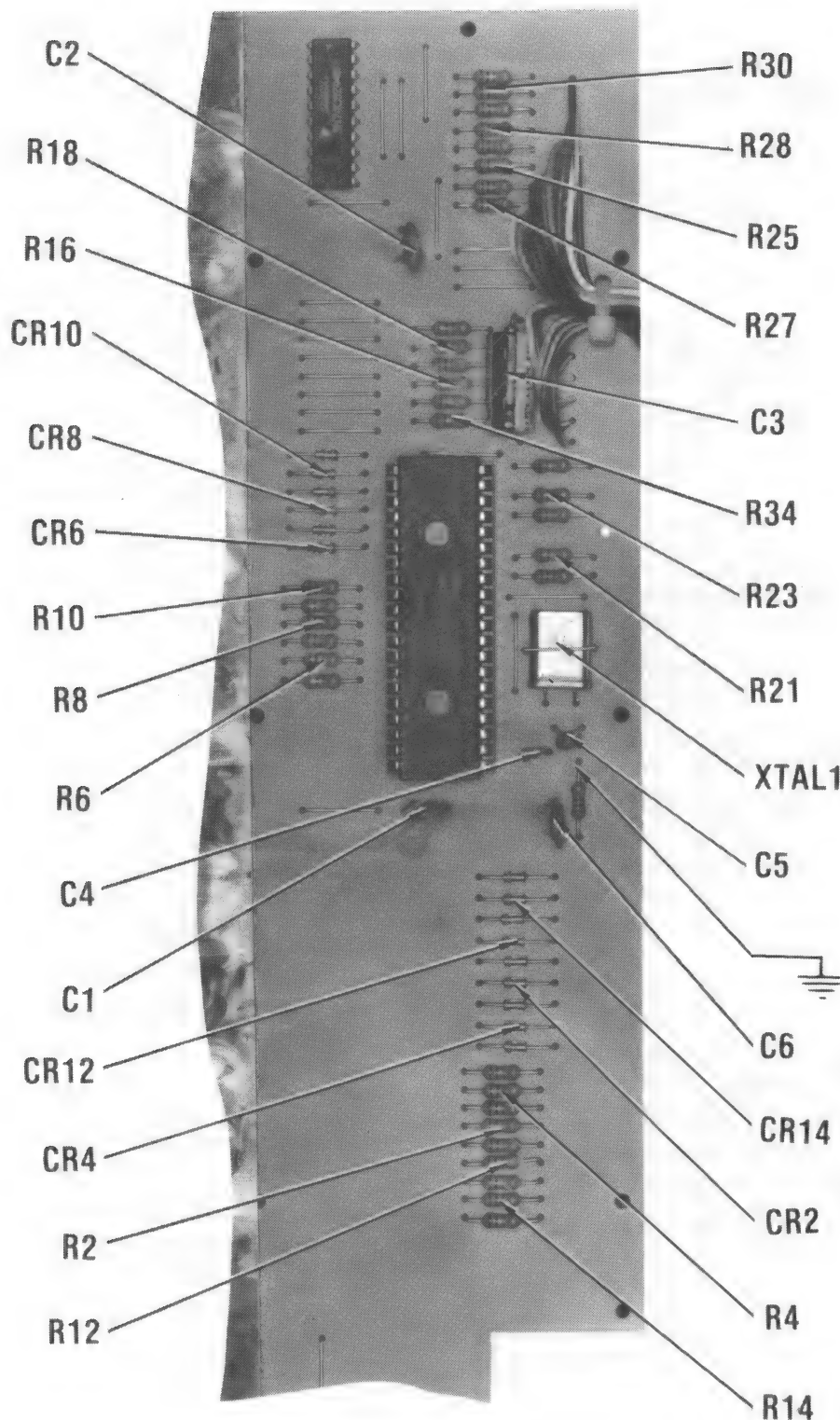




NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

# CSCS12

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## GENERAL OPERATING INSTRUCTIONS

### POWER UP SEQUENCE

Turn On Monitor and Disk Drive. Turn On Computer. Disk Drive will run for a few seconds. After Disk Drive stops running, Monitor will display instructions to insert the System Disk into Disk Drive. After TOS System Disk has been inserted in to Drive, use the Mouse to move the pointer on the OK box and click left Mouse button once. The Busy light on front panel of Disk Drive will come On as the Operating System is loaded into Computer. NOTE: System Disk can also be loaded into Computer by pressing the RETURN key on Keyboard.

### DISK OPERATING SYSTEM (TOS)

When the Operating System has been loaded into Computer, the Monitor will display the Menu Bar along Top of screen and three Icons along left side. Two are Floppy Disk Icons used to control the Disk Drives and the other is a Trash Icon used to erase files from a disk. When two drives are used, Floppy Disk Icon A controls Drive A and Floppy Disk Icon B controls Drive B.

To load a program from a diskette, use the Mouse to move pointer on icon representing the appropriate Disk Drive. Click left Mouse button twice in rapid succession to open Disk Drive. Disk Drive can also be opened by clicking left Mouse button once and then moving pointer up to the File heading on Menu Bar at top of screen. When File window drops down from Menu Bar, move pointer until the word "Open" is shaded and then press left Mouse button once. When Disk Drive opens, icons representing files on the disk will appear on the screen. To open a program file, move pointer on the program icon and click left Mouse button twice. It is also possible to open a program file by clicking left Mouse button once while pointer is on the program icon and then clicking on "Open" after dropping File window down from Menu Bar. NOTE: Programs written in Basic cannot be loaded until the Basic language has been loaded into Computer.

### BASIC

To load Basic language into Computer, remove TOS System disk from Disk Drive after operating system has been loaded into Computer. Insert Basic language disk into Disk Drive and then open drive as described in the "DISK OPERATING SYSTEM" section of the General Operating Instructions. Move pointer to Basic Program icon and load program into Computer. To go from Basic back to TOS Operating System, drop File window down from Menu Bar and select Close Window option.

To load a Basic program from Disk Drive, pull File Window down from Menu Bar and click left Mouse button with pointer on "Open". A list of Basic programs on the Disk will appear in the Item Selector Dialog Box on the screen. Move pointer to desired program and click left Mouse button. When the chosen program title becomes shaded, move pointer to OK box and click left Mouse button again. The program will be loaded into Computer. The program can also be loaded by typing LOAD, the program name and then pressing RETURN.

To save a Basic program on disk, pull File window down from Menu Bar and click left Mouse button with pointer on "Save As" option. Type the name of the program in the Item Selector Dialog Box. Move pointer to OK box and click left Mouse button to save program. The program can also be saved by typing SAVE, the program name and then pressing the RETURN key.

### USING A BLANK DISKETTE

A blank diskette must be formatted before it can be used to save data. To format a diskette, select the Floppy Disk icon for the Disk Drive to be used. Use the pointer to pull down File window from Menu Bar and then select Format option from File menu. The first Format Box will be displayed on the screen. Insert diskette to be formatted into appropriate Disk Drive and click left Mouse button with pointer on the OK box. The Format Dialog Box will be displayed on the screen. Select proper drive option and move pointer to Format box. Click left Mouse button to begin formatting.

To copy TOS operating system onto a blank diskette, insert TOS System diskette into Disk Drive. Select Floppy Disk A icon with the Mouse and drag it on top of the Floppy Disk B icon and then release left Mouse button. A Dialog Box will be displayed warning that copying Disk A to Disk B will erase the information on Disk B. Move pointer to OK box and click left Mouse button. When Diskcopy Box is displayed on the screen, move pointer to the Copy box and click left Mouse button. Follow the prompts displayed on the screen until copying process is completed.

### USING THE KEYBOARD TO CONTROL THE MOUSE POINTER

The Keyboard cursor keys can be used in place of the Mouse to move pointer around the screen. Pressing the ALTERNATE key and any of the cursor keys will move pointer eight pixels. Press the ALTERNATE and SHIFT keys and any of the cursor keys to move the cursor 1 pixel. Pressing the ALTERNATE and INSERT keys has the same effect as clicking the left Mouse key. To "drag" an icon, press the ALTERNATE and INSERT keys and a cursor key at same time.



## SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Computer system before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with Computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This Computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the Computer system to water. If exposed to water turn the unit off. Do not place the Computer system near possible water sources.
14. Never leave the Computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning Computer system.
17. Never use liquids or aerosols directly on the Computer system. Spray on cloth and then apply to the Computer system cabinet. Make sure the Computer system is disconnected from the AC power line.

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MODEL 520ST

## SCHEMATIC NOTES

—\*— Circuitry not used in some versions

--- Circuitry used in some versions

◊ See parts list

≡ Ground

mm Voltages measured with digital meter.

Waveforms and voltages are taken from ground, unless noted otherwise.

Voltages, waveforms and logic probe readings taken with Boot Up Display on Monitor screen.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm width with DC reference voltage given at the bottom line of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltage maintained as shown at input.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolytic capacitors are 50 volts or less, 20% unless noted.

Resistors are  $\frac{1}{2}W$  or less, 5% unless noted.

Value in ( ) used in some versions.

Measurements taken with switching as shown, unless noted.

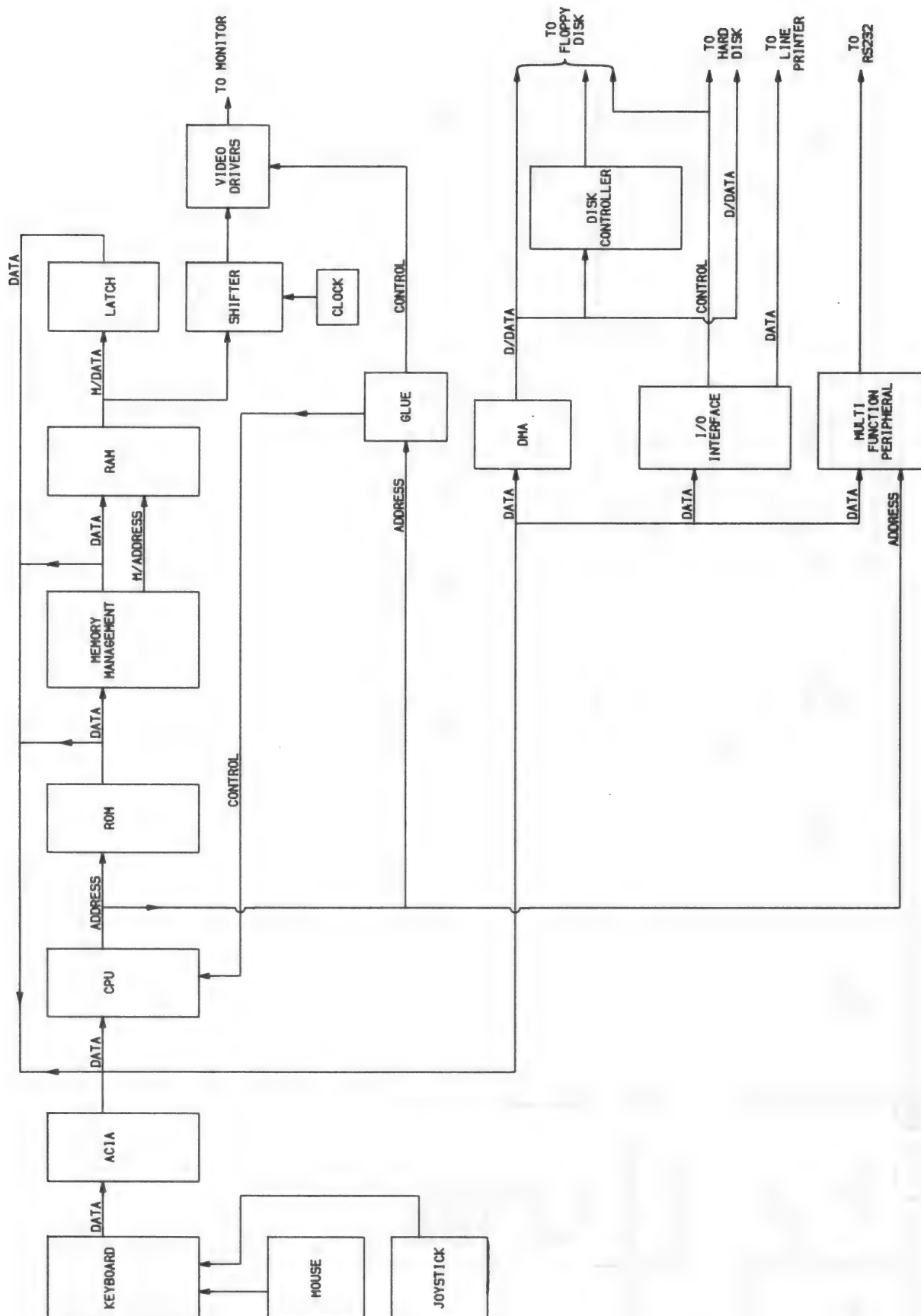
Logic Probe Display

L = Low

H = High

P = Pulse

\* = Open (No lights On)



# CSCS12 ATARI MODEL 520ST

BLOCK DIAGRAM



## PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

## SEMICONDUCTORS (Select replacement transistor for best results)

SEMICONDUCTORS (Select replacement transistor for 2004 models)								
ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			NOTES	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
KEYBOARD								
CR1 thru CR15	HD6301V1E01P SN74LS244N			NTE519	ECG519	SK3100/519	WEP925/519	103-131
IC1 IC2				NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
POWER SUPPLY BOARD								
D1 thru D4	1N5400			NTE5800	ECG5800	SK9003/5800	WEP4000/5800	212-Z9000
D5	CTB-24			NTE6085	ECG6085	SK3311	WEP154	212-76-02 905-427
D6,7 IC1	1N4001 MB3759			NTE116	ECG116			
IC2,3	L78M12CV			NTE966	ECG966	SK3592/966	WEP966L/966	HE-442-674
Q1	2SB825			NTE197	ECG197	SK3083/197	WEP757/197	121-988-03
Q2	2SC1384R			NTE293	ECG293	SK3849/293	WEP914/297	121-Z9066
Q3	2SC1815GR			NTE85	ECG85	SK3124A/289A	WEP66/199	121-Z9065

## PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			NOTES	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
MAIN BOARD								
CR1 thru CR7	1N914			NTE519	ECG519	SK3100/519	WEP925/519	103-131
CR8,CR9			(5)	NTE519	ECG519	SK3100/519	WEP925/519	103-131
Q1 thru Q6	2N3904			NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q7	2N3906			NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
Q8	2N3904			NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q9	2N3906		(5)	NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
Q10	2N3904		(5)	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
U1	C025913-38							
U2,U3	C026160-001		(5)					
U4	C026034-01		(5)					
	C026162-001							
U5	C026163-001		(5)					
U6	C026164-001		(5)					
U7	C026035-01		(5)					
	C026165-001							
U8	M53206P			NTE7406	ECG7406	SK7406		HE-443-698
	7406PC		(5)	NTE7406	ECG7406	SK7406		HE-443-698
U9	C026028							
U10	MC68000P8		(5)					
	HD68000P8							
U11	SC87898P							
U12	C025915-38							
U13	UA1489APC			NTE75189	ECG75189	SK5189/75189		HE-443-795
	MC1489P		(5)	NTE75189	ECG75189	SK5189/75189		HE-443-795
U14	MC1488P			NTE75188	ECG75188	SK5188/75188		HE-443-794
U15	C025912-38							

## 22 PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			NOTES	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
U16 thru U18 U19 U20, 21	D41256C-15  YM2149F MC6850P			NTE6850	ECG6850			
U22, 23	M74LS373P SN74LS373N		(5)	NTE74LS373 NTE74LS373	ECG74LS373 ECG74LS373	SK74LS373 SK74LS373		HE-443-867 HE-443-867
U24, 25 U26	D41256C-15 DM74LS244N 74LS244N		(5)	NTE74LS244 NTE74LS244	ECG74LS244 ECG74LS244	SK74LS244 SK74LS244		HE-443-791 HE-443-791
U27	74LS244N SN74LS244N		(5)	NTE74LS244 NTE74LS244	ECG74LS244 ECG74LS244	SK74LS244 SK74LS244		HE-443-791 HE-443-791
U28 thru U30	D41256C-15							
U31	C025914-38 C025914-38A		(5)					
U32 thru U34	D41256C-15							
U35 U36	M74LS04P SN74LS05N M74LS05P		(5)	NTE74LS04 NTE74LS05 NTE74LS05	ECG74LS04 ECG74LS05 ECG74LS05	SK74LS04 SK74LS05 SK74LS05		HE-443-755 HE-443-818 HE-443-818
U37	556D			NTE978	ECG978	SK3689/978		221-29152
U38 U39 U40	D41256C-15 PC900 M74LS02P SN74LS02N			NTE74LS02 NTE74LS02	ECG74LS02 ECG74LS02	SK74LS02 SK74LS02		HE-443-779 HE-443-779
U41 U42 thru U45	HD74HC74P D41256C-15		(5)					

(5) Used In some versions.



## PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C31	1 50V Non-Polarized	
C34	1 50V Non-Polarized	

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R6 R12 R17 R18 VR2	<b>POWER SUPPLY BOARD</b> 4700 1% 1/4W Metal Film 4700 1% 1/4W Metal Film 3000 1% 1/4W Metal Film 3300 1% 1/4W Metal Film 200 1% 1/4W Metal Film			
RP1 RP2 RP3 RP4 RP5 RP6	<b>SYSTEM BOARD</b> Resistor Network (1) Resistor Network (1) Resistor Network (1) Resistor Network (2) Resistor Network (1) Resistor Network (1)			

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MODEL 520ST

- (1) Contains nine (9 ea.) 10K, 5%.  
(2) Contains nine (9 ea.) 4700, 5%.

### COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
L1 L2 L18 L20 L29 T1	<b>POWER SUPPLY BOARD</b> Choke Choke Choke Choke Choke Power Transformer			
L3 L19 L22	<b>SYSTEM BOARD</b> Choke Choke Choke			

## PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### FUSE DEVICES

ITEM NO.	DESCRIPTION	MFR. PART NO.		NOTES
		DEVICE	HOLDER	
R19	<b>POWER SUPPLY BOARD</b> 5A @ 250V Quick Acting			

### MISCELLANEOUS

ITEM No.	PART NAME	MFR. PART No.	NOTES
	<b>KEYBOARD</b>		
LED 1	LED		Power
L1	Ferrite Bead		
SW1	Switch		Keys
Thru SW94			
XTAL 1	Crystal		4MHz
	<b>POWER SUPPLY</b>		
L24	Ferrite Bead		
L27	Ferrite Bead		
L28	Ferrite Bead		
L30	Ferrite Bead		
SW1	Switch		Power
	<b>MAIN BOARD</b>		
L5	Network		
Thru L10	Network		
L12	Network		
Thru L16	Network		
L17	Ferrite Bead		
L21	Ferrite Bead		
L25	Ferrite Bead		
L26	Ferrite Bead		
L31	Ferrite Bead		
L55	Network		
Thru L65	Network		
L67	Network		
Thru L83	Network		
L91	Network		
L92	Network		
SW2	Switch	Reset	
Y1	Crystal	2.4576MHz	
Y2	Crystal	32.0414MHz	
Y3	Crystal	3.579575MHz	

### WIRING DATA

Shielded Hook-up Wire .....	Use BELDEN No. 8401 or 8421 (Single-Conductor)
	8208 (Two-Conductor)
	9534 (Four-Conductor)
General-use Unshielded Hook-up Wire .....	Use BELDEN No. 8529 (Solid) Available In 13 Colors
	8522 (Stranded) Available In 13 Colors
75-Ohm Input Lead .....	Use BELDEN No. 8241

## TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

### TEST EQUIPMENT (COMPUTERFACTS)

Equipment Name	B & K Precision Equipment No.	Sencore Equipment No.
OSCILLOSCOPE	1570A, 1590A, 1596	SC61
LOGIC PROBE	DP51	
LOGIC PULSER	DP101	
DIGITAL VOM	2830	DVM37, DVM56, SC61
ANALOG VOM	277	
ISOLATION TRANSFORMER	TR110, 1604, 1653, 1655	PR57
FREQUENCY COUNTER	1803, 1805	FC71, SC61
COLOR BAR GENERATOR	1211A, 1248, 1251, 1260	CG25, VA62
RGB GENERATOR	1260	
FUNCTION GENERATOR	3020	
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44	HP200
TEMPERATURE PROBE	TP-28	
CRT ANALYZER	467, 470	CR70

## TROUBLESHOOTING

### COMPUTER DEAD

Check for 5V at junction of Capacitors C71 and C72. If voltage is missing, check for 5V at terminal 14 of Choke Coil L3. If 5V is present at terminal 14 of L3, check Power Switch (SW1). If 5V is missing at terminal 14 of L3, check for 5V at pins 1 and 6 of Power Supply Connector J9. If 5V is present at J9, check Coil L3. If voltage is missing at pins 1 and 6 of J9, refer to the "Power Supply" section of this Troubleshooting guide.

If 5V is present at junction of Capacitors C71 and C72, check for pulses on Data lines (pins 1 thru 5 and pins 54 thru 64) and Address lines (pins 29 thru 48 and pins 50 thru 52) of CPU IC (U10). If pulses are missing at any pins, refer to the "Microprocessor Operation" section of this Troubleshooting guide.

### POWER SUPPLY

Note: When servicing the Power Supply, disconnect Connector P9 from Computer to avoid possible damage to Computer. Connect a load to the 5V source (pins 1 and 6 of Plug P9), the 12V source (pin 4 of Plug P9) and the -12V source (pin 5 of Plug P9). Use a 5 ohm, 10 watt resistor as a load for the 5V and 560 ohm, 1/2 watt resistors for the 12V and -12V sources.

5V source missing. Check Fuse R19. If Fuse R19 is open, check Diodes D1 thru D4 and Electrolytics C1 and C2 for possible shorts. If Fuse R19 is open, check for approximately 15.6V at emitter of Regulator Transistor (Q1). If

voltage is missing at emitter of Q1, check Power Transformer (T1) and Diodes D1 thru D4. Also check for an open power cord. If voltage is normal at emitter of Q1, check for 5.0V at collector of Q1. If 5.0V is missing at collector of Q1, check Transistors Q1 and Q2, Error Amplifier (IC1), and associated components. If 5.0V is present at collector of Q1, check Coils L1 and L2. Also check Power Supply cable and Connector P9.

5V source is low. Check for approximately 15.6V at emitter of Regulator Transistor (Q1). If voltage at emitter of Q1 is low, check Diode D1 thru D4 and Electrolytics C1 and C2. If voltage at emitter of Q1 is normal, check Transistors Q1 and Q2, Error Amplifier IC1 and associated components.

5V source is too high. Check Transistors Q1 and Q2 for possible shorts or leakage. Also check Error Amplifier (IC1) and associated components.

12V source missing. Check for approximately 17.4V at pin 1 of Voltage Regulator (IC2). If voltage at pin 1 of IC2 is missing, check Diode D7 and Power Transformer (T1). If the voltage at pin 1 of IC2 is low, check Electrolytic C11. If voltage at pin 1 of IC2 is normal, check IC2 and Electrolytic C12.

-12V source missing. Check for approximately 19.5V across Electrolytic C9. If voltage is missing at C9, check Diode D6 and Power Transformer (T1). If voltage is low across Electrolytic C9, check C9. If voltage is normal across C9, check Voltage Regulator (IC3) and Electrolytic C10.

## TROUBLESHOOTING (Continued)

### MICROPROCESSOR OPERATION

Computer is dead. Power supply checks good. Use a scope or a logic probe to check data lines (pins 1 thru 5 and pins 54 thru 64) of CPU IC (U10) for activity. If there is no activity on data lines, check operation of reset circuit by observing the logic reading at pin 18 of CPU IC (U10). Pin 18 of IC U10 should be Low when Computer is turned On and then go immediately High. The reading on Pin 18 should also be Low whenever the Reset Switch (SW2) is pressed. If the logic reading is not correct at pin 18 of the IC U10 when Computer is turned On, check ICs U36 and U37, Capacitors C48 and C50, and Resistor R83. If Power On reset works properly but the Reset Switch does not work, check Switch SW2, ICs U36 and U37, Resistors R82 and R93 and Capacitors C55 and C70.

If the reset circuit works properly, check for 8MHz clock signal at pin 15 of CPU IC (U10). If clock signal is missing, check for 16MHz clock signal at pin 5 of Memory Management Unit IC (U15). If 16MHz clock signal is present at pin 5 of IC U15, check IC U15. If clock signal is missing at pin 5 of IC U15, check for 32MHz clock signal at pin 2 of Shifter IC (U31). If 32MHz clock signal is present at pin 2 of IC U31, check IC U31. If 32MHz signal is missing at pin 2 of IC U31, check Crystal Y2, Transistors Q6 and Q8, and other components associated with the 32MHz oscillator circuit.

If the 8MHz clock signal is present at pin 15 of IC U10, check for a logic High at pins 13, 17 and 22 of IC U10. If the logic reading is not correct at any of these pins, check components connected to the pin having an incorrect reading. Also check IC U10. If any of the address or data lines are not generating valid TTL logic levels, check IC U10 and Memory Management Unit IC (U15). If IC U10 and IC U15 are good, check the other devices on the address or data bus for possible shorts.

### VIDEO

No video when using the Monochrome Monitor. Check waveform at pin 30 of the Shifter IC (U31). If waveform is present at pin 30 of IC U31, check waveform at emitter of Video Output Transistor (Q2). If video waveform is missing at the emitter of Q2, check Transistor Q2 and associated components. If video waveform is present at emitter of Q2, check for video waveform at pin 11 of Connector J6. If waveform is missing at pin 11 of J6, check Resistor R42. If waveform is present at pin 11 of J6, check J6 for a good connection. Also check the Monitor.

No video when using Color Monitor. Check for video waveforms at anodes of Diodes CR1, CR2 and CR3. If the video waveforms are present at the diodes, check for video waveforms at emitters of Q3, Q4 and Q5. If waveforms are missing at emitters of Q3, Q4 and Q5, check for 5V at collectors of Q3, Q4 and Q5. If voltage is missing at collectors of Q3, Q4 and Q5, check Choke Coil L18. If video waveforms are present at emitters of Q3, Q4 and Q5, check Connector J6 and the Monitor.

If video waveform is missing at pin 30 of Shifter IC (U31) when the Monochrome Monitor is connected or the video waveforms are missing at pins 21 thru 29 of IC U31 when the Color Monitor is connected, check IC U31 and Glue IC (U12). If random dots or bars appear on the screen, check Memory Management Unit IC (U15), IC U31, and ROM ICs (U4 and U7). If the screen is scrambled, check IC U12 and IC U15.

### COLOR

Missing Colors. Type in and run the following basic program:

```
10 Z = 10
20 C = 2
30 FOR X = 100 TO 300 STEP 100
40 LINE# X,0,X,166
50 COLOR 1,C,1
60 C = C + 1
70 FILL Z,0
80 Z = Z + 100
90 NEXT X
100 GOTO 100
```

With the program running, the screen should display a red vertical bar, a green vertical bar and a blue vertical bar. Note: The Computer must be connected to the RGB Monitor for this troubleshooting procedure.

No red. Check video waveform (see Figure 1) at anode of Diode CR1. If the video waveform is missing at the anode of CR1, check Shifter IC (U31). If the video signal is present at anode of CR1, check for the red video waveform at emitter of Red Output Transistor (Q5). If video waveform is missing at emitter of Q5, check Transistor Q5 and associated components. If video waveform is present at emitter of Q5, check for the video waveform at pin 7 of Connector J6. If video waveform is missing at pin 7 of J6, check Resistor R117. If video waveform is present at pin 7 of J6, check Connector J6 and the Monitor.

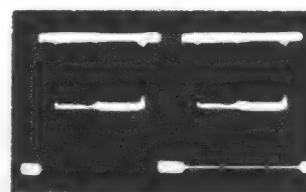


Figure 1

No green. Check for a video waveform (see Figure 1) at anode of CR2. If the green video waveform is missing at anode of CR2, check Shifter IC (U31). If video waveform is present at anode of CR2, check for the green video waveform at emitter of Green Output Transistor (Q4). If video waveform is missing at emitter of Q4, check Transistor Q4 and associated components. If video waveform is present at emitter of Q4, check for the video waveform at pin 6 of Connector J6. If the video waveform is missing at pin 6 of J6, check Resistor R116. If video waveform is present at pin 6 of Connector J6, check Connector J6 and the Monitor.

No blue. Check for a video waveform (see Figure 1) at anode of CR3. If the blue video waveform is missing at anode of CR3, check Shifter IC (U31). If video waveform is present at anode of CR3, check for a video waveform at emitter of Blue Output Transistor (Q3). If video waveform is missing at emitter of Q3, check Transistor Q3 and associated components. If video waveform is present at emitter of Q3, check for the video waveform at pin 10 of Connector J6. If video waveform is missing at pin 10 of J6 check Resistor R115. If video waveform is present at pin 10 of J6, check Connector J6 and the Monitor.



## TROUBLESHOOTING (Continued)

### SOUND

No sound. Type in and run the following Basic program:

```
10 SOUND 1,12,12,4,50
```

This program produces a continuous sound from the Monitor speaker. While program is running, check for the waveform in Figure 2 at pin 4 of I/O Interface IC (U19). If waveform is missing at pin 4 of U19, check for 2MHz clock signal at pin 22 of U19. If clock signal is missing at pin 22 of U19, check GLUE IC (U12). If the clock signal is present at pin 22 of U19, check for pulses at pins 27 and 29 of U19. If pulses are missing at either pin 27 or pin 29 of U19, check IC U40. If pulses are present at pins 27 and 29 of U19, check IC U19. Also check Capacitor C95 for a possible short.

If waveform in Figure 2 is present at pin 4 of U19, check for sound signal at base of Audio Output Transistor (Q1). If signal is missing at base of Q1, check Capacitor C31. If sound signal is present at base of Transistor Q1, check for signal at emitter of Q1. If sound signal is missing at the emitter of Q1, check Transistor Q1 and associated components. If sound signal is present at emitter of Q1, check for signal at pin 1 of Connector J6. If sound signal is missing at pin 1 of J6, check Capacitor C33. If sound signal is present at pin 1 of J6, check Connector J6 and the Monitor.

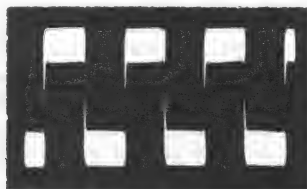


Figure 2

### KEYBOARD

Keyboard is dead. Note: Most keys are inactive until a language such as Basic has been loaded into Computer. If Keyboard is dead with Basic loaded into Computer, check for pulses at pin 2 of ACIA IC (U21) while depressing any key. If pulses are missing at pin 2 of U21, check for pulses at pin 14 of Keyboard Connector J12 while depressing any key. If pulses are present at pin 14 of J12, check L92. If pulses are missing at pin 14 of J12, check Keyboard Connector J12 for good connections. Also check for broken wires between pins 1, 13, 14, 15 and 16 of Keyboard Connector J12 and the Keyboard. If Connector J12 and the wires between the Keyboard and Connector J12 are good, check Microcomputer IC (IC1) and the 4.0MHz Crystal (XTAL1) on the Keyboard assembly.

If there are pulses on pin 2 of U21 when the keys are pressed, check for 500kHz clock signal on pin 3 of U21. If clock signal is missing at pin 3 of U21, check GLUE IC (U12). If 500kHz clock signal is present at pin 3 of U21, check U21.

Type in and run the following Basic program:

```
10 OUT 4,100: GOTO 10
```

While running the above program, check for pulses at pin 15 of Keyboard Connector J12. If pulses are missing at pin 15 of J12, check for pulses at pin 6 of U21. If the pulses are present at pin 6 of U21, check L91. If pulses are missing at pin 6 of U21, check U21.

If a single key does not work, check the defective key for continuity when the key is pressed. Clean or repair defective key.

If any group of keys do not work, check for a defective Diode (CR1 thru CR15) associated with that group of keys. Also check Microcomputer IC (IC1) on the Keyboard assembly.

### DISK DRIVE INTERFACE

Drive motor will not turn On. Check for a logic Low at pin 12 of IC U8 while attempting to read data from Disk Drive. If pin 12 of U8 does not read logic Low, check for a logic High at pin 20 of Floppy Disk Controller IC (U9). If pin 20 of IC U9 is logic High, check IC U8. If pin 20 of U9 is not logic High, check IC U9. Also check DMA Controller IC (U1) and I/O Interface IC (U19). If pin 12 of IC U8 is logic Low, check Floppy Disk Connector (J3) for good connections.

Computer will not read from Disk Drive. When attempting to read data from Drive 0, check for a logic Low at pin 5 of Floppy Disk Connector J3. If pin 5 of J3 does not read logic Low, check L64 and IC U19. When attempting to read data from Disk Drive 1, check for a logic Low at pin 6 of J3. If the logic reading is correct at pin 5 or pin 6 of J3, use a scope to check for data pulses at pin 1 of Connector J3. If data pulses are missing at pin 1 of J3, check Connector J3 for a good connection at pin 1. If data pulses are present at pin 1 of J3, check for data pulses at pin 19 of Floppy Disk Controller IC (U9). If data pulses are missing at pin 19 of U9, check L66. If data pulses are present at pin 19 of U9, use a scope to check for data pulses at pins 5 thru 12 of U9. If data pulses are present at pins 5 thru 12 of U9, check DMA Controller IC (U1).

Computer will not write to Disk Drive. Check for a logic High at pin 25 of Floppy Disk Controller IC (U9). If pin 25 of U9 is not logic High, check Resistor R13. Also make sure that the diskette in the Drive is not write protected. Check the Drive Select lines (pins 5 and 6 of Connector J3) as described in the paragraph above. If the correct logic levels are present on the Drive Select lines, check for Low going WRITE command signals at pin 2 of U9 while attempting to write data to the diskette. If the WRITE signals are missing at pin 2 of U9, check DMA Controller IC (U1). If the WRITE signals are present at pin 2 of U9, check for write data pulses at pin 11 of Connector J3.

If write data pulses are present at pin 11 of J3, check Connector J3 for good connections. If write data pulses are missing at pin 11 of J3, check for write data pulses at pin 22 of Floppy Disk Controller IC (U9). If data pulses are present at pin 22 of U9, check IC U8 and L65. If data pulses are missing at pin 22 of U9, check for write data pulses at pins 29 thru 36 of DMA Controller IC (U1). If data pulses are present at pins 29 thru 36 of U1, check U9. If data pulses are missing at pins 29 thru 36 of U1, check U1.

### HARD DISK PORT

Computer will not read from or write to a known good Hard Disk and Controller. Check Hard Disk Port Connector (J2) for good connections. Check DMA Controller IC (U1). Check Floppy Disk Controller IC (U9) it may be loading down the data or control lines connected to J2.

## TROUBLESHOOTING (Continued)

### PRINTER PORT

Printer interface is not functioning. Connect pin 11 of Printer Connector J5 to ground. Type in and run the following Basic program:

```
10 OUT 0,255: OUT 0,0: GOTO 10
```

While the above program is running, check for pulses at pins 6 thru 13 and pin 16 of I/O Interface IC (U19). If pulses are missing on any of the pins, check U19. If pulses are present at pins 6 thru 13 and pin 16 of U19, check Printer Connector J5 for good connections. Also check Multi-Function Peripheral IC (U11).

### RS232 SERIAL PORT

Check for 12V at pin 14 of IC U14 and -12V at pin 1 of U14. If either of these voltages are missing, refer to the "Power Supply" section of this Troubleshooting Guide. Check Serial Port Connector J4 for good connections. Check waveform at pin 17 of Multi Function Peripheral IC (U11). If waveform is missing at pin 17 of U11, check Crystal Y1, Capacitors C10 and C11, and IC U11.

Type in and run the following Basic program:

```
10 OUT 1,100: GOTO 10
```

With the program running, check for data pulses at pin 8 of Multi Function Peripheral IC (U11). If data pulses are missing at pin 8 of U11, check U11. If data pulses are present at pin 8 of U11, check for data pulses at pin 8 of IC U14. If pulses are missing at pin 8 of U14, check U14. If pulses are present at pin 8 of U14, check for data pulses at pin 2 of Connector J4. If data pulses are missing at pin 2 of J4, check L72.

Connect a 5V, 5000Hz square wave from the TTL output of a Function Generator to pin 3 of Serial Port Connector J4. Check for pulses at pin 1 of IC U13. If pulses are missing at pin 1 of U13, check L71. If pulses are present at pin 1 of U13, check for pulses at pin 9 of Multi Function Peripheral IC (U11). If data pulses are missing at pin 9 of U11, check IC U13. If pulses are present at pin 9 of U11, check U11. Remove 5000Hz signal from pin 3 of J4.

Check for a logic Low at pins 17 and 18 of I/O Interface IC (U19). If the logic readings are not correct at pins 17 and 18 of U19, check U19. If pins 17 and 18 of U19 are Low, check for a logic High at pins 3 and 11 of U14. If logic readings are not correct at either pin 3 or pin 11 of U14, check U14. If pins 3 and 11 of U14 are High, check for a logic High at pins 4 and 20 of Serial Port Connector J4. If pin 4 of J4 is not High, check L70. If pin 20 of J4 is not High, check L68.

To check the RS232 input lines (pins 3, 5, 8 and 22 of Connector J4), connect 5.0V Source to pin 3 of J4 through a 1K, 1/4 watt Resistor. Check for a logic Low at pin 3 of U13. If pin 3 of U13 is not Low, check U13 and L71. Move the 1K Resistor to pin 5 of Connector J4 and check for a Low at pin 11 of U13. If pin 11 of U13 is not Low, check U13 and L69. Move the 1K Resistor to pin 8 of Connector J4 and check for a logic Low at pin 6 of U13. If pin 6 of U13 is not Low, check

U13 and L67. Move the 1K Resistor to pin 22 of Connector J4 and check for a logic Low at pin 8 of U13. If pin 8 of U13 is not Low, check U13 and L73.

### MIDI PORTS

The MIDI (Musical Instrument Digital Interface) ports are used to connect Computer to external electronic musical devices.

Output port is not functioning. Type in and run the following Basic program:

```
10 OUT 3,100: GOTO 10
```

With the above program running, check for pulses at pin 5 of MIDI Output J8. If pulses are present at pin 5 of J8, check Connector J8 for good connections. If pulses are missing at pin 5 of J8, check for pulses at pin 5 of IC U36. If pulses are present at pin 5 of U36, check IC U36. If pulses are missing at pin 5 of U36, check for pulses at pin 6 of ACIA IC (U20). If pulses are present at pin 6 of U20, check IC U35. If pulses are missing at pin 6 of U20, check U20.

Input port is not functioning. Connect a 5 volt, 5000Hz square wave from the TTL output of a Function Generator to MIDI Input Connector J7 (High side to pin 4, Low side to pin 5). Check for pulses at pin 1 of Optocoupler U39. If pulses are missing at pin 1 of U39, check Resistor R76 and Diode CR7. Also check Connector J7. If pulses are present at pin 1 of U39, check for pulses at pin 2 of ACIA IC (U20). If pulses are missing at pin 2 of U20, check Optocoupler U39. If pulses are present at pin 2 of U20, check U20. If input pulses are present at pin 2 of U20 but missing at the output (pin 3 of J8), check for pulses at pin 4 of U35. If pulses are missing at pin 4 of U35, check U35. If pulses are present at pin 4 of U35, check U36.

### MOUSE/JOYSTICK 0 PORT

Check for pulses at pin 14 of Keyboard Connector J12 while moving the Mouse or Joystick 0 up, down, left or right. If pulses are present at pin 14 of J12 but the Mouse or Joystick has no effect, refer to the "Keyboard" section of this Troubleshooting Guide. If there are no pulses at pin 14 of J12, check for pulses at pins 2, 4, 6 and 8 of Buffer IC (IC2) on the Keyboard. If pulses are missing at pins 2, 4, 6 or 8 of IC2, check Connectors J11 and J12. Also check Coils L8, L9, L12 and L14 on the System Board. If pulses are present at pins 2, 4, 6 and 8 of IC2, check for pulses at pins 12, 14, 16 and 18 of IC2. If pulses are missing at pins 12, 14, 16 and 18 of IC2, check Microcomputer IC (IC1) on the Keyboard.

If the Left Mouse Button or the Joystick Fire Button does not function, check for a logic Low on pin 9 of Microcomputer IC (IC1) while pressing the button. If the Low is not present, check Connectors J11 and J12 and Coil L13. Also check for a defective Mouse or Joystick. If there is a Low at pin 9 of IC1 when the button is pressed, check IC1. If the Right Mouse Button does not function, check for a logic Low at pin 10 of IC1 while pressing the button. If the Low is not present, check Connectors J11 and J12 and Coil L10. Also check for a defective Mouse. If there is a Low at pin 10 of IC1 when the button is pressed, check IC1.

## TROUBLESHOOTING (Continued)

### JOYSTICK 1 PORT

Check for pulses at pin 14 of J12 while moving Joystick 1 up, down, left or right. If the pulses are present at pin 14 of J12 but Joystick 1 has no effect, refer to the "Keyboard" section of this Troubleshooting Guide. If there are no pulses at pin 14 of J12, check for pulses at pins 11, 13, 15 and 17 of Buffer IC (IC2) on the Keyboard while moving Joystick 1. If pulses are missing at pins 11, 13, 15 and 17 of IC2, check Connectors J10 and J12. Also check Coils L5, L6, L7, L15 and L16 on the System Board. If pulses are pre-

sent at pins 11, 13, 15 and 17 of IC2, check for pulses at pins 3, 5, 7 and 9 of IC2. If pulses are missing at pins 3, 5, 7 and 9 of 2, check IC2. If the pulses are present at pins 3, 5, 7 and 9 of IC2, check Microcomputer IC (IC1) on the Keyboard.

If the Joystick Fire Button does not function, check for a logic Low at pin 10 of Microcomputer IC (IC1) while pressing the button. If the Low is not present, check Connectors J10 and J12 and Coil L10. Also check for a defective Joystick. If there is a Low at pin 10 of IC1 when the button is pressed, check IC1.

## LINE DEFINITIONS

6850CS ..... 6850 Chip Select  
A1 THRU A23 ..... Address  
ACK ..... Acknowledge  
ANALOG ..... Analog  
AS ..... Address Strobe  
BERR ..... Bus Error  
BG ..... Bus Grant  
BGACK ..... Bus Grant Acknowledge  
BLANK ..... Blanking Pulses  
BR ..... Bus Request  
BUSY ..... Busy  
CA1  
CASOH ..... Column Address Strobe, High Byte  
CASOL ..... Column Address Strobe, Low Byte  
CD  
CI  
CR/W ..... Controller Read/Write  
CS ..... Chip Select  
D0 THRU D15 ..... Data  
DD0 THRU DD7 ..... Data  
DE  
DEV  
DIRECTION IN ..... Stepper Motor Direction  
DMA ..... Direct Memory Access  
DOWN ..... Down, Joystick Control  
DRIVE 0 SELECT ..... Drive 0 Select  
DRIVE 1 SELECT ..... Drive 1 Select  
DTACK ..... Data Transfer Acknowledge  
E ..... Enable  
ER  
FC0, FC1, FC2 ..... Function Code 0, 1, 2 (Status Lines)  
FCS  
FDRQ ..... Data Request  
GPO  
HDRQ  
HSYNC ..... Horizontal Sync  
IACK ..... Interrupt Acknowledge  
INDEX ..... Index Sensor  
INDEX PULSE ..... Index Sensor Pulses  
INT ..... Initialize  
INTR ..... Interrupt  
IOD0 THRU IOD7 ..... Input/Output Data, Bits 1 Thru 7  
IPL1, 2 ..... Interrupt Priority Lines 1, 2  
IRQ ..... Interrupt Request  
L BUTTON/FIRE BUTTON ..... L Button/Fire Button

LATCH ..... Latch  
LDS ..... Lower Data Strobe  
LEFT ..... Left, Joy Stick Control  
LOAD ..... Load  
MAD0 THRU MAD8 ..... Memory Address, Dynamic RAM  
MD0 THRU MD15 ..... Memory Data  
MDCS  
MFPCS ..... Multi-Function Peripheral Chip Select  
MFPINT ..... Multi-Function Peripheral Initialize  
MONOMON ..... Monochrome Monitor  
MOTOR ON ..... Motor Operating Indicator  
R BUTTON/FIRE BUTTON ..... R Button/Fire Button  
R/W ..... Read/Write  
RAM ..... RAM Chip Select  
RAS0 ..... Row Address Strobe  
RD ..... Read Data  
RDAT ..... Read Data  
RDY ..... Ready  
READ DATA ..... Read Data  
RESET ..... Reset  
RIGHT ..... Right, Joystick Control  
ROM 0 THRU ROM 4 ..... ROM Chip Select Lines  
RXDATA ..... Receive Data  
SD  
SIDE 0 SELECT ..... Side 0 Select  
SNDCS ..... Sound Chip Select  
STEP ..... Stepper Motor Pulses  
STROBE ..... Strobe  
TRACK 00 ..... Track 00 Sensor  
UDS ..... Upper Data Strobe  
UP ..... Up, Joystick Control  
VMA ..... Valid Memory Address  
VPA ..... Valid Peripheral Address  
VSYNC ..... Vertical Sync  
WDAT ..... Write Data  
WE ..... Write Enable  
WRITE DATA ..... Write Data  
WRITE GATE ..... Write Gate  
WRITE PROTECT ..... Write Protect Sensor  
X0 THRU X7 ..... X Axis, Bits 0 Thru 7  
XA/DOWN ..... X Axis A/Down  
XB/UP ..... X Axis B/Up  
YA/LEFT ..... Y Axis A/Left  
YB/RIGHT ..... Y Axis B/Right

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# LOGIC CHART

## MAIN BOARD

PIN NO.	IC U1	PIN NO.	IC U1	PIN NO.	IC U4	PIN NO.	IC U4	PIN NO.	IC U7	PIN NO.	IC U7	PIN NO.	IC U8
1	P	21	L	1	H	21	P	1	H	21	P	1	H
2	P	22	P	2	P	22	P	2	P	22	P	2	L
3	P	23	L	3	P	23	P	3	P	23	P	3	L
4	P	24	H	4	P	24	P	4	P	24	P	4	H
5	P	25	H	5	P	25	P	5	P	25	P	5	L
6	P	26	P	6	P	26	P	6	P	26	P	6	H
7	P	27	P	7	P	27	P	7	P	27	P	7	L
8	P	28	L	8	P	28	H	8	P	28	H	8	H
9	P	29	P	9	P			9	P			9	L
10	P	30	P	10	P			10	P			10	H
11	P	31	P	11	P			11	P			11	L
12	P	32	P	12	P			12	P			12	H
13	P	33	P	13	P			13	P			13	L
14	P	34	P	14	L			14	L			14	H
15	P	35	P	15	P			15	P				
16	P	36	P	16	P			16	P				
17	P	37	H	17	P			17	P				
18	P	38	P	18	P			18	P				
19	P	39	P	19	P			19	P				
20	L	40	H	20	P			20	P				

PIN NO.	IC U9	PIN NO.	IC U9	PIN NO.	IC U10	PIN NO.	IC U10	PIN NO.	IC U10	PIN NO.	IC U10
1	P	21	L	1	P	21	P	41	P	61	P
2	H	22	L	2	P	22	H	42	P	62	P
3	P	23	P	3	P	23	P	43	P	63	P
4	P	24	H	4	P	24	P	44	P	64	P
5	P	25	H	5	P	25	H	45	P		
6	P	26	L	6	P	26	H	46	P		
7	P	27	L	7	P	27	P	47	P		
8	P	28	L	8	P	28	P	48	P		
9	P			9	P	29	P	49	H		
10	P			10	P	30	P	50	P		
11	P			11	H	31	P	51	P		
12	P			12	H	32	P	52	P		
13	H			13	H	33	P	53	L		
14	L			14	H	34	P	54	P		
15	H			15	P	35	P	55	P		
16	L			16	L	36	P	56	P		
17	L			17	H	37	P	57	P		
18	P			18	H	38	P	58	P		
19	P			19	P	39	P	59	P		
20	L			20	P	40	P	60	P		



# LOGIC CHART (Continued)

## MAIN BOARD

PIN NO.	IC U11	PIN NO.	IC U11	PIN NO.	IC U11	PIN NO.	IC U12	PIN NO.	IC U12	PIN NO.	IC U12	PIN NO.	IC U12
1	P	21	H	41	P	1	H	21	H	41	H	61	P
2	P	22	H	42	P	2	P	22	H	42	L	62	P
3	P	23	H	43	P	3	P	23	P	43	P	63	P
4	P	24	H	44	P	4	P	24	H	44	H	64	P
5	P	25	H	45	H	5	P	25	P	45	H	65	P
6	P	26	H	46	P	6	P	26	P	46	P	66	P
7	L	27	H	47	P	7	P	27	H	47	P	67	P
8	*	28	H	48	P	8	P	28	P	48	P	68	P
9	H	29	L			9	P	29	P	49	P		
10	L	30	L			10	P	30	H	50	H		
11	H	31	H			11	P	31	P	51	P		
12	*	32	H			12	P	32	P	52	L		
13	L	33	H			13	H	33	P	53	P		
14	L	34	L			14	P	34	P	54	P		
15	L	35	P			15	P	35	L	55	P		
16	L	36	L			16	P	36	P	56	P		
17	P	37	P			17	H	37	P	57	P		
18	P	38	P			18	H	38	P	58	P		
19	H	39	P			19	P	39	P	59	P		
20	P	40	P			20	H	40	L	60	P		

PIN NO.	IC U13	PIN NO.	IC U14	PIN NO.	IC U15	PIN NO.	IC U15	PIN NO.	IC U15	PIN NO.	IC U15
1	L	1	L	1	P	21	H	41	P	61	L
2	L	2	L	2	P	22	H	42	P	62	P
3	H	3	H	3	P	23	P	43	P	63	P
4	L	4	*	4	P	24	H	44	H	64	P
5	L	5	*	5	P	25	P	45	P	65	P
6	H	6	L	6	P	26	P	46	P	66	P
7	L	7	L	7	P	27	L	47	P	67	P
8	H	8	L	8	P	28	P	48	P	68	P
9	L	9	*	9	P	29	P	49	P		
10	L	10	*	10	H	30	P	50	P		
11	H	11	H	11	P	31	P	51	P		
12	L	12	L	12	P	32	P	52	P		
13	L	13	L	13	P	33	P	53	P		
14	H	14	H	14	P	34	P	54	P		
15				15	P	35	P	55	P		
16				16	P	36	P	56	P		
17				17	P	37	P	57	P		
18				18	P	38	P	58	P		
19				19	P	39	P	59	P		
20				20	P	40	P	60	P		

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# LOGIC CHART (Continued)

## MAIN BOARD

PIN NO.	IC U16	PIN NO.	IC U17	PIN NO.	IC U18	PIN NO.	IC U19	PIN NO.	IC U19	PIN NO.	IC U20	PIN NO.	IC U20
1	P	1	P	1	P	1	L	21	H	1	L	21	P
2	P	2	P	2	P	2	*	22	P	2	H	22	P
3	P	3	P	3	P	3	H	23	H	3	P	23	L
4	P	4	P	4	P	4	H	24	L	4	P	24	L
5	P	5	P	5	P	5	*	25	H	5	L		
6	P	6	P	6	P	6	L	26	H	6	H		
7	P	7	P	7	P	7	L	27	P	7	H		
8	H	8	H	8	H	8	L	28	H	8	L		
9	P	9	P	9	P	9	L	29	P	9	L		
10	P	10	P	10	P	10	L	30	P	10	P		
11	P	11	P	11	P	11	L	31	P	11	P		
12	P	12	P	12	P	12	L	32	P	12	H		
13	P	13	P	13	P	13	L	33	P	13	P		
14	P	14	P	14	P	14	L	34	P	14	P		
15	P	15	P	15	P	15	L	35	P	15	P		
16	L	16	L	16	L	16	L	36	P	16	P		
17						17	L	37	P	17	P		
18						18	L	38	H	18	P		
19						19	H	39	L	19	P		
20						20	P	40	H	20	P		

PIN NO.	IC U21	PIN NO.	IC U21	PIN NO.	IC U22	PIN NO.	IC U23	PIN NO.	IC U24	PIN NO.	IC U25	PIN NO.	IC U26
1	L	21	P	1	P	1	P	1	P	1	P	1	P
2	H	22	P	2	P	2	P	2	P	2	P	2	P
3	P	23	L	3	P	3	P	3	P	3	P	3	P
4	P	24	L	4	P	4	P	4	P	4	P	4	P
5	L			5	P	5	P	5	P	5	P	5	P
6	H			6	P	6	P	6	P	6	P	6	P
7	H			7	P	7	P	7	P	7	P	7	P
8	L			8	P	8	P	8	H	8	H	8	P
9	P			9	P	9	P	9	P	9	P	9	P
10	H			10	L	10	L	10	P	10	P	10	L
11	P			11	P	11	P	11	P	11	P	11	P
12	H			12	P	12	P	12	P	12	P	12	P
13	P			13	P	13	P	13	P	13	P	13	P
14	P			14	P	14	P	14	P	14	P	14	P
15	P			15	P	15	P	15	P	15	P	15	P
16	P			16	P	16	P	16	L	16	L	16	P
17	P			17	P	17	P					17	P
18	P			18	P	18	P					18	P
19	P			19	P	19	P					19	P
20	P			20	H	20	H					20	H

# LOGIC CHART (Continued)

## MAIN BOARD

PIN NO.	IC U27	PIN NO.	IC U28	PIN NO.	IC U29	PIN NO.	IC U30	PIN NO.	IC U31	PIN NO.	IC U31	PIN NO.	IC U32
1	P	1	P	1	P	1	P	1	H	21	L	1	P
2	P	2	P	2	P	2	P	2	P	22	L	2	P
3	P	3	P	3	P	3	P	3	P	23	L	3	P
4	P	4	P	4	P	4	P	4	P	24	L	4	P
5	P	5	P	5	P	5	P	5	P	25	L	5	P
6	P	6	P	6	P	6	P	6	P	26	L	6	P
7	P	7	P	7	P	7	P	7	P	27	L	7	P
8	P	8	H	8	H	8	H	8	P	28	L	8	H
9	P	9	P	9	P	9	P	9	P	29	L	9	P
10	L	10	P	10	P	10	P	10	P	30	P	10	P
11	P	11	P	11	P	11	P	11	P	31	P	11	P
12	P	12	P	12	P	12	P	12	P	32	P	12	P
13	P	13	P	13	P	13	P	13	P	33	P	13	P
14	P	14	P	14	P	14	P	14	P	34	P	14	P
15	P	15	P	15	P	15	P	15	P	35	P	15	P
16	P	16	L	16	L	16	L	16	P	36	P	16	L
17	P							17	P	37	P		
18	P							18	P	38	P		
19	P							19	P	39	P		
20	H							20	L	40	H		

PIN NO.	IC U33	PIN NO.	IC U34	PIN NO.	IC U35	PIN NO.	IC U36	PIN NO.	IC U37	PIN NO.	IC U38	PIN NO.	IC U39
1	P	1	P	1	H	1	L	1	L	1	P	1	*
2	P	2	P	2	L	2	H	2	L	2	P	2	*
3	P	3	P	3	H	3	L	3	*	3	P	3	*
4	P	4	P	4	L	4	H	4	H	4	P	4	H
5	P	5	P	5	H	5	L	5	L	5	P	5	L
6	P	6	P	6	L	6	*	6	H	6	P	6	H
7	P	7	P	7	L	7	L	7	L	7	P	7	
8	H	8	H	8	P	8	*	8	H	8	H	8	
9	P	9	P	9	P	9	L	9	L	9	P	9	
10	P	10	P	10	L	10	H	10	H	10	P	10	
11	P	11	P	11	*	11	L	11	*	11	P	11	
12	P	12	P	12	L	12	H	12	H	12	P	12	
13	P	13	P	13	*	13	L	13	L	13	P	13	
14	P	14	P	14	H	14	H	14	H	14	P	14	
15	P	15	P	15		15		15		15	P	15	
16	L	16	L	16		16		16		16	L	16	

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## LOGIC CHART (Continued)

### MAIN BOARD

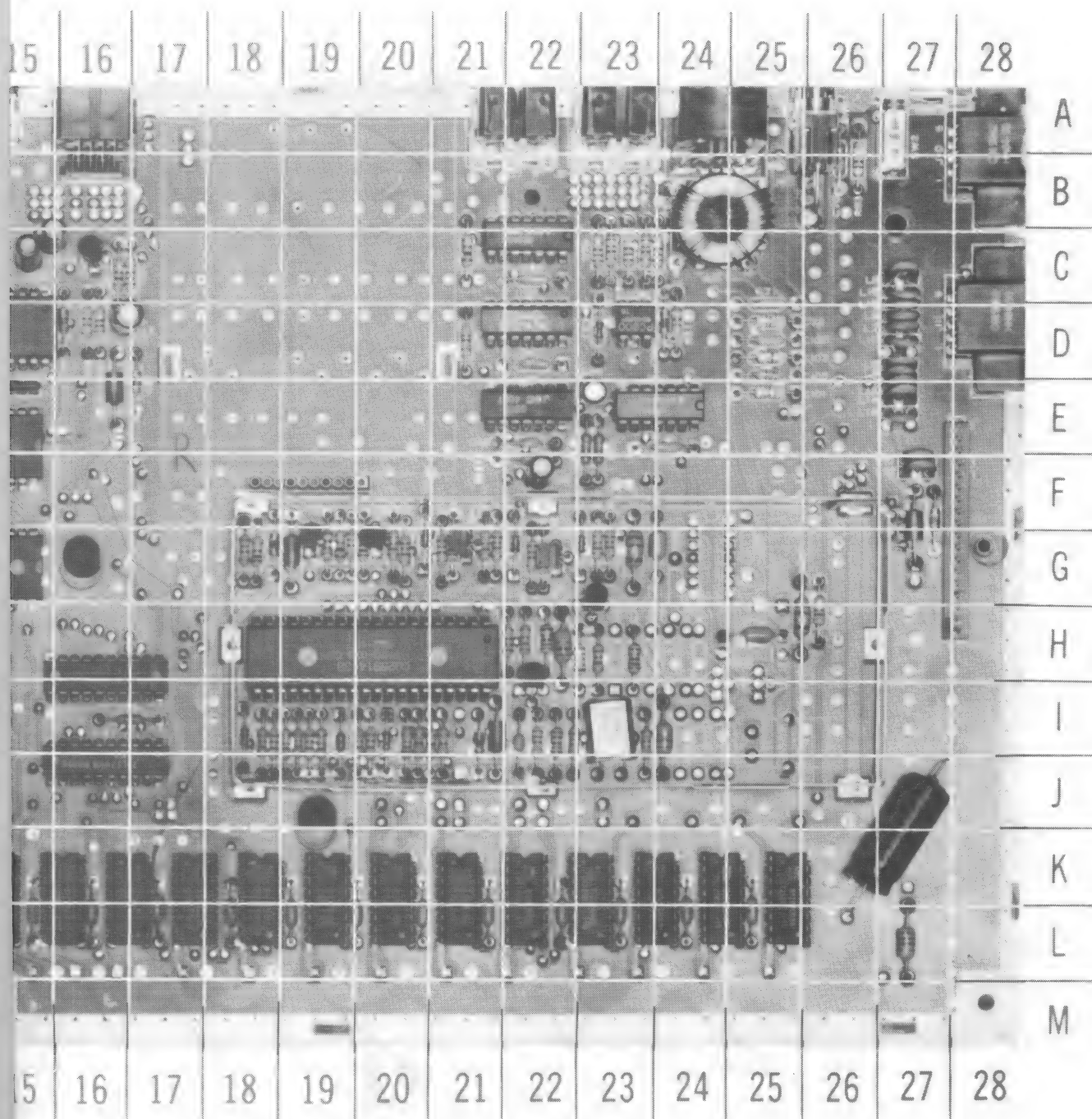
PIN NO.	IC U40	PIN NO.	IC U42	PIN NO.	IC U43	PIN NO.	IC U44	PIN NO.	IC U45
1	P	1	P	1	P	1	P	1	P
2	P	2	P	2	P	2	P	2	P
3	P	3	P	3	P	3	P	3	P
4	H	4	P	4	P	4	P	4	P
5	L	5	P	5	P	5	P	5	P
6	L	6	P	6	P	6	P	6	P
7	L	7	P	7	P	7	P	7	P
8	*	8	H	8	H	8	H	8	H
9	*	9	P	9	P	9	P	9	P
10	L	10	P	10	P	10	P	10	P
11	P	11	P	11	P	11	P	11	P
12	P	12	P	12	P	12	P	12	P
13	P	13	P	13	P	13	P	13	P
14	H	14	P	14	P	14	P	14	P
15		15	P	15	P	15	P	15	P
16		16	L	16	L	16	L	16	L

### KEYBOARD

PIN NO.	IC1	PIN NO.	IC1	PIN NO.	IC2
1	L	21	H	1	P
2	P	22	P	2	H(1)
3	P	23	P	3	P
4	H	24	P	4	H(1)
5	H	25	P	5	P
6	H	26	P	6	H(1)
7	H	27	P	7	P
8	P	28	P	8	H(1)
9	H	29	P	9	P
10	H	30	P	10	L
11	H	31	P	11	H(1)
12	H	32	P	12	P
13	H	33	P	13	H(1)
14	H	34	P	14	P
15	H	35	P	15	H(1)
16	H	36	P	16	P
17	H	37	H	17	H(1)
18	H	38	H	18	P
19	H	39	*	19	P
20	H	40	P	20	H

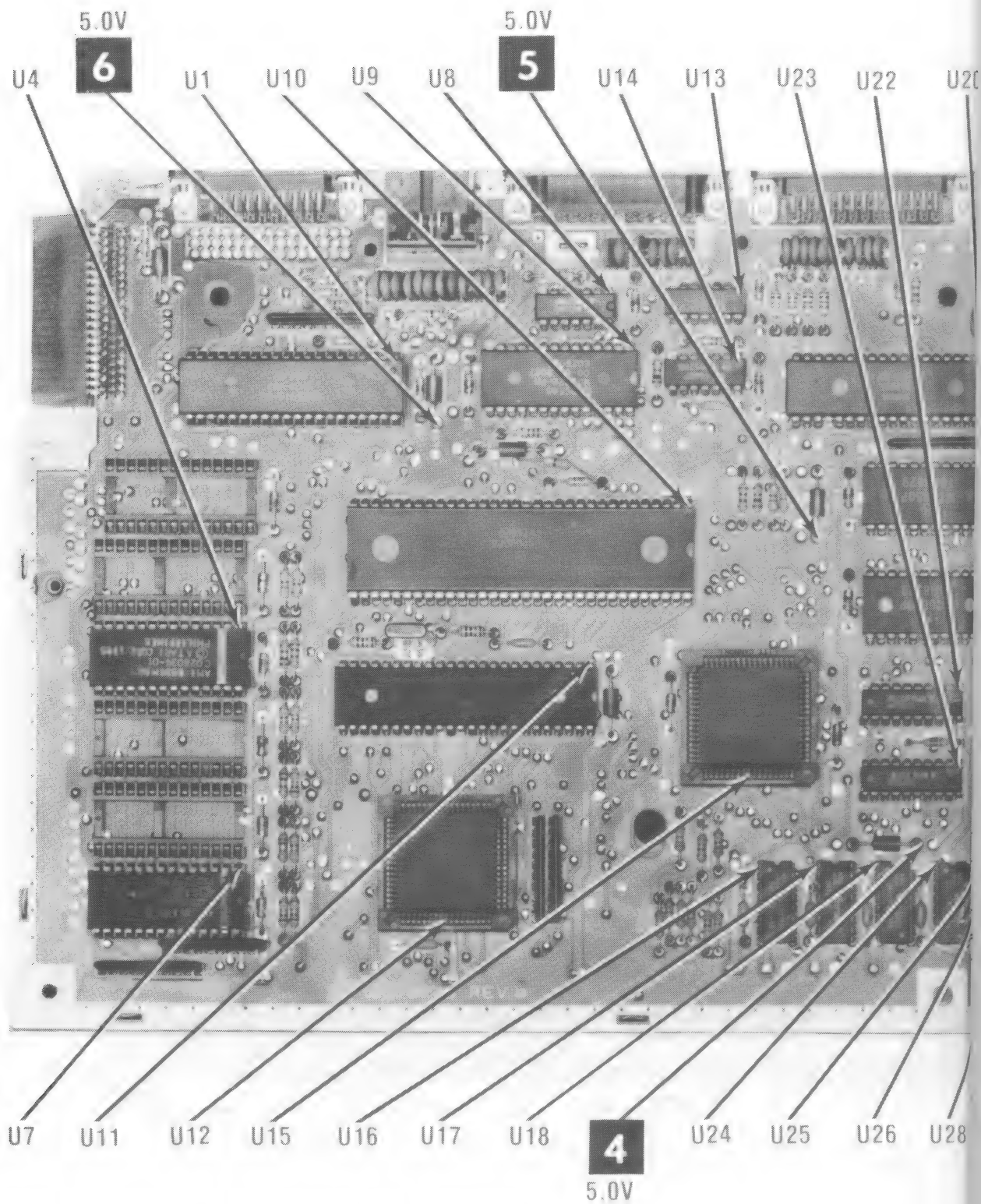
(1) Pulses when using mouse or joystick.





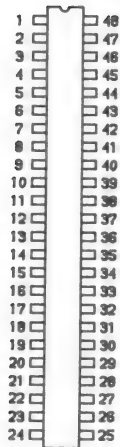
ATARI  
MODEL 520ST

MAIN BOARD

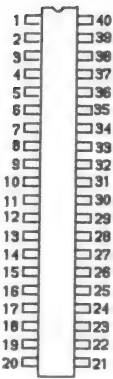


NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

## SYSTEM BOARD



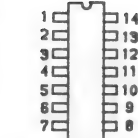
U11  
TOP VIEW



U1, U19, U31  
TOP VIEW



U2 THRU U7  
TOP VIEW

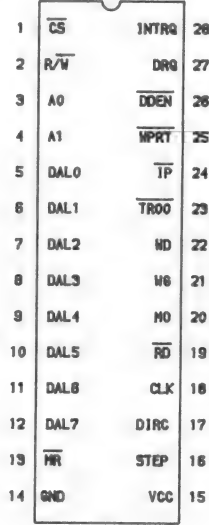


U8, U13, U14  
U35, U36, U39, U40  
TOP VIEW

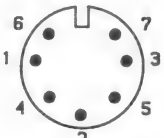


Q1 THRU Q6, Q8  
BOTTOM VIEW

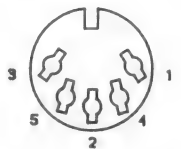
C026028



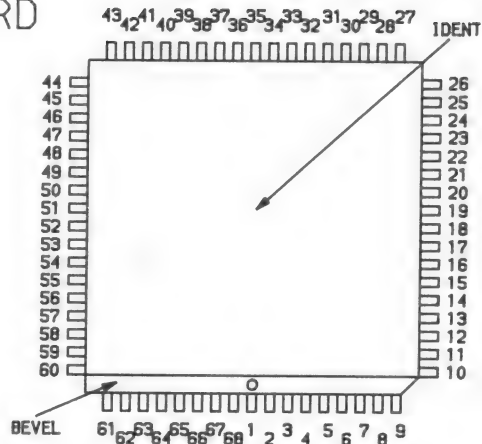
U9  
FLOPPY DISK CONTROLLER  
TOP VIEW



J9  
FRONT VIEW

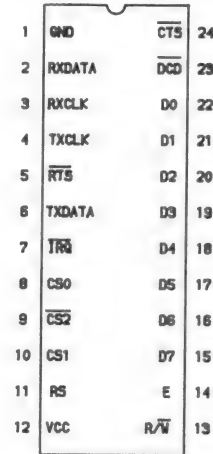


J7, J8  
EXTERNAL VIEW



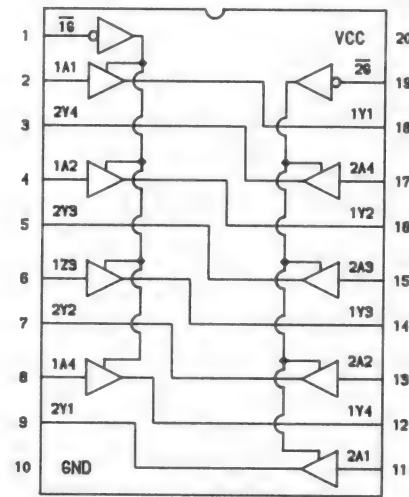
U12, U15  
TOP VIEW

MC6850P

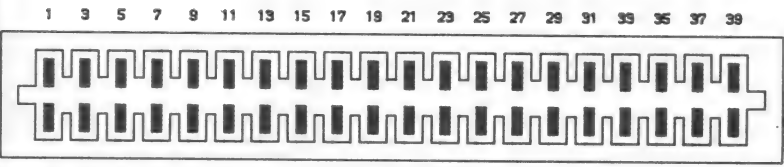


U20, U21  
ACIA TOP VIEW

DM74LS244N, 74LS244N



U26, U27  
TRI-STATE BUFFER  
TOP VIEW



J1  
FRONT VIEW

ATARI  
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## **DISASSEMBLY INSTRUCTIONS**

### **CABINET REMOVAL**

Remove six Phillips screws from cabinet bottom. Lift cabinet top up to remove.

### **MAIN BOARD REMOVAL**

Unplug and remove keyboard. Remove three Phillips screws from front of Main board top shield. Straighten eleven metal tabs holding top shield to Main board. Carefully remove shield from top of Main board. Remove three Phillips screws from back of Main board. Lift front of Main board and pull forward until board is free of cabinet. Remove bottom shield from Main board.

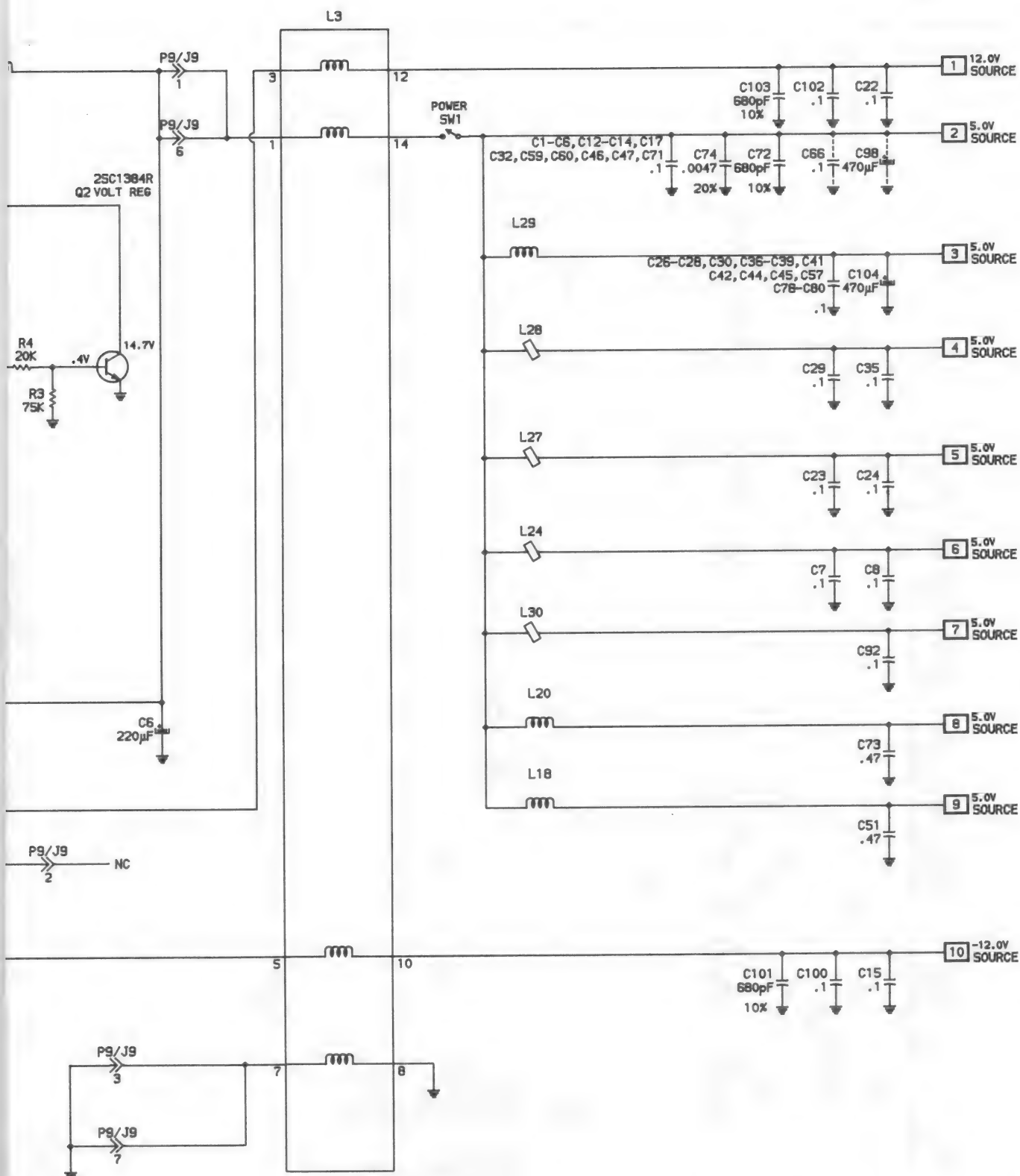
### **KEYBOARD**

Lay Keyboard face down and remove 26 Phillips screws holding Printed Circuit board to Keyboard case. Carefully lift off board. NOTE: Each key has a rubber cup with a contact button mounted in the center. Unless Keyboard is properly supported to prevent any keys from being depressed, the rubber cups will pop out when circuit board is removed. When reassembling Keyboard, it must be properly supported to insert the rubber cups for each key. Carefully position circuit board on bottom of Keyboard assembly and replace 26 Phillips screws.

### **POWER SUPPLY**

Remove four rubber feet from bottom of Power Supply case by prying them out with a small screwdriver. Remove four Phillips screws that are exposed when rubber feet are removed. Turn Power Supply upright and lift off top half of case.





ATARI  
MODEL 520ST

A PHOTOFAC STANDARD NOTATION SCHEMATIC

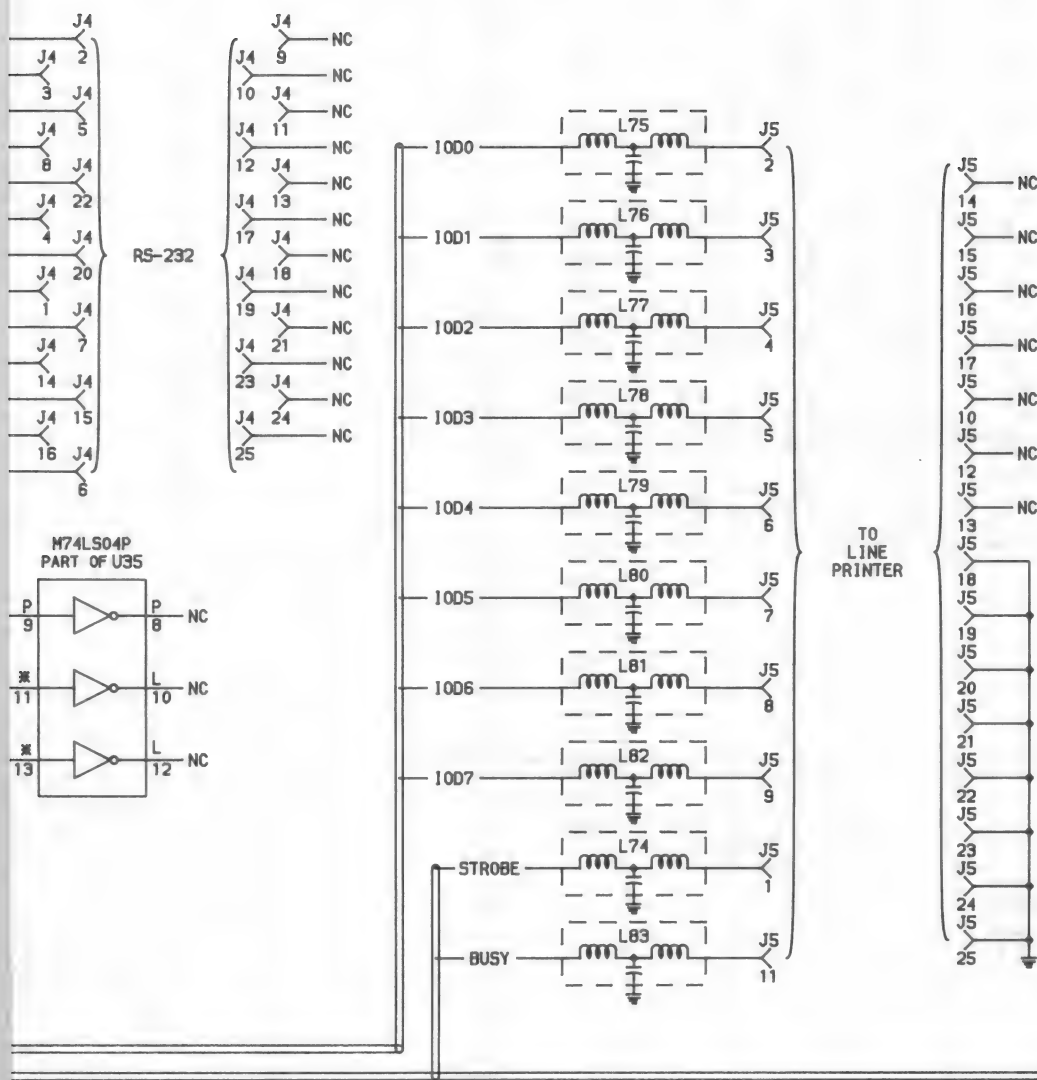
WITH **CIRCUITRACE**

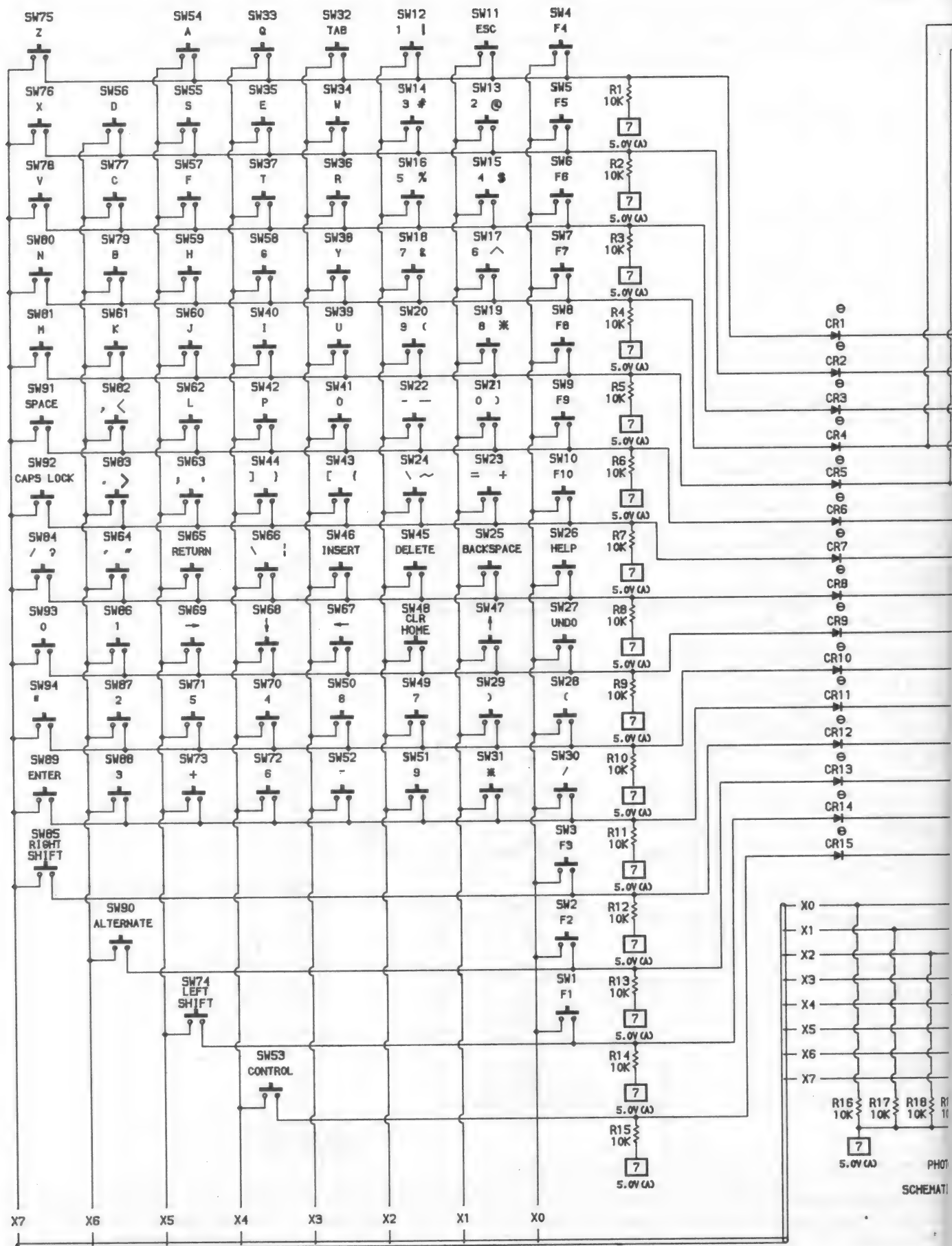
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POWER SUPPLY

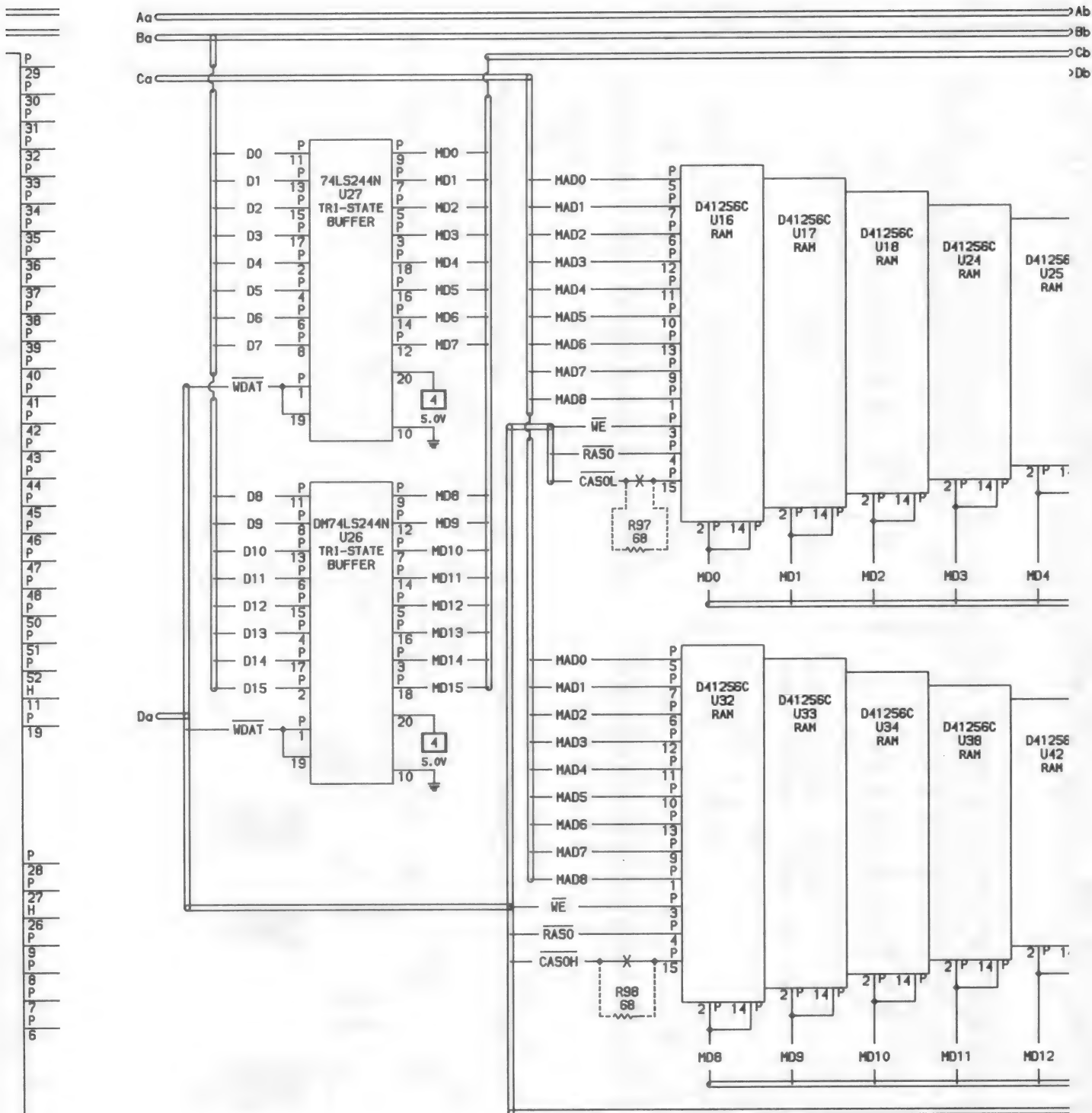


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KEYBOARD



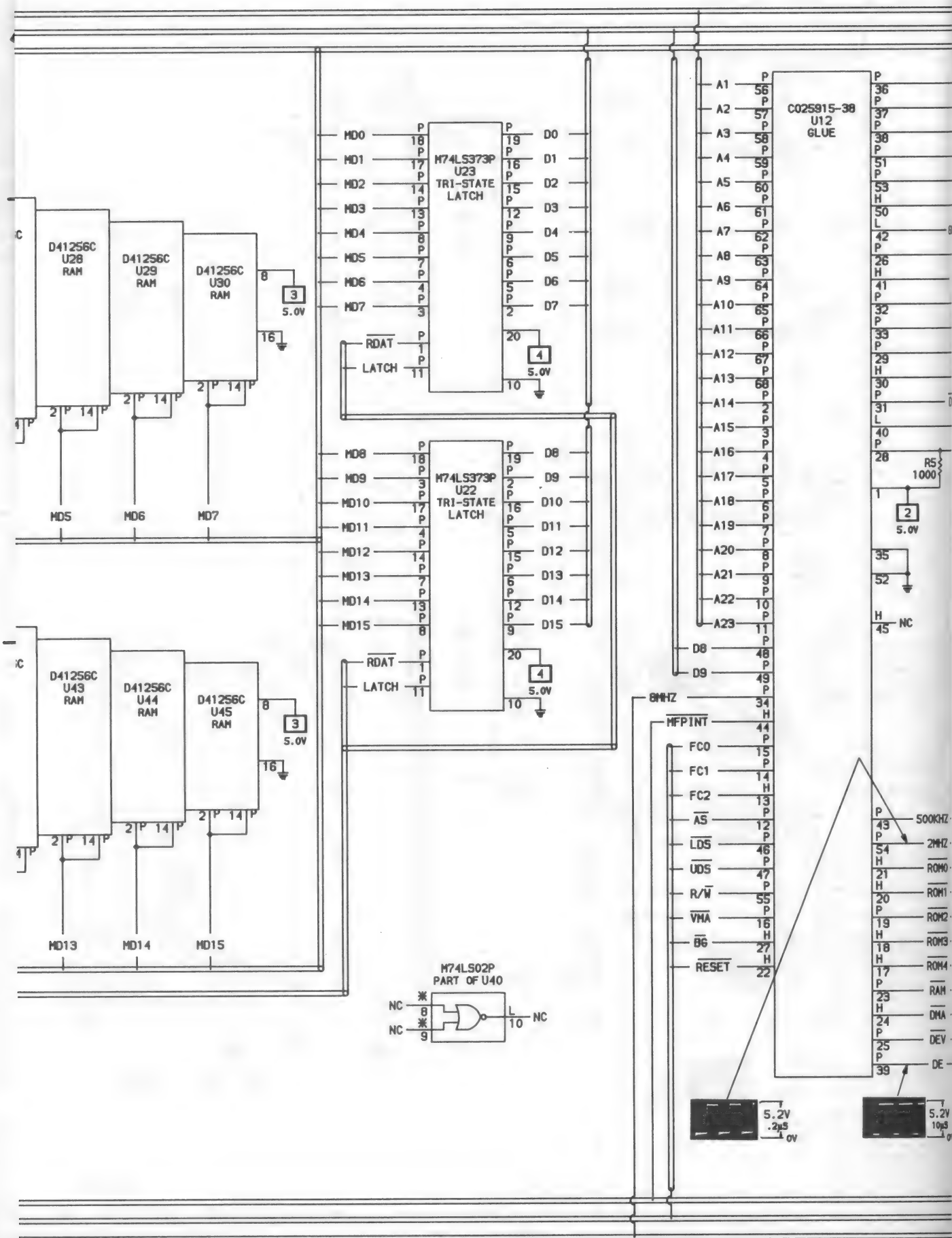
A PHOTOFAC STANDARD NOTATION SCHEMATIC

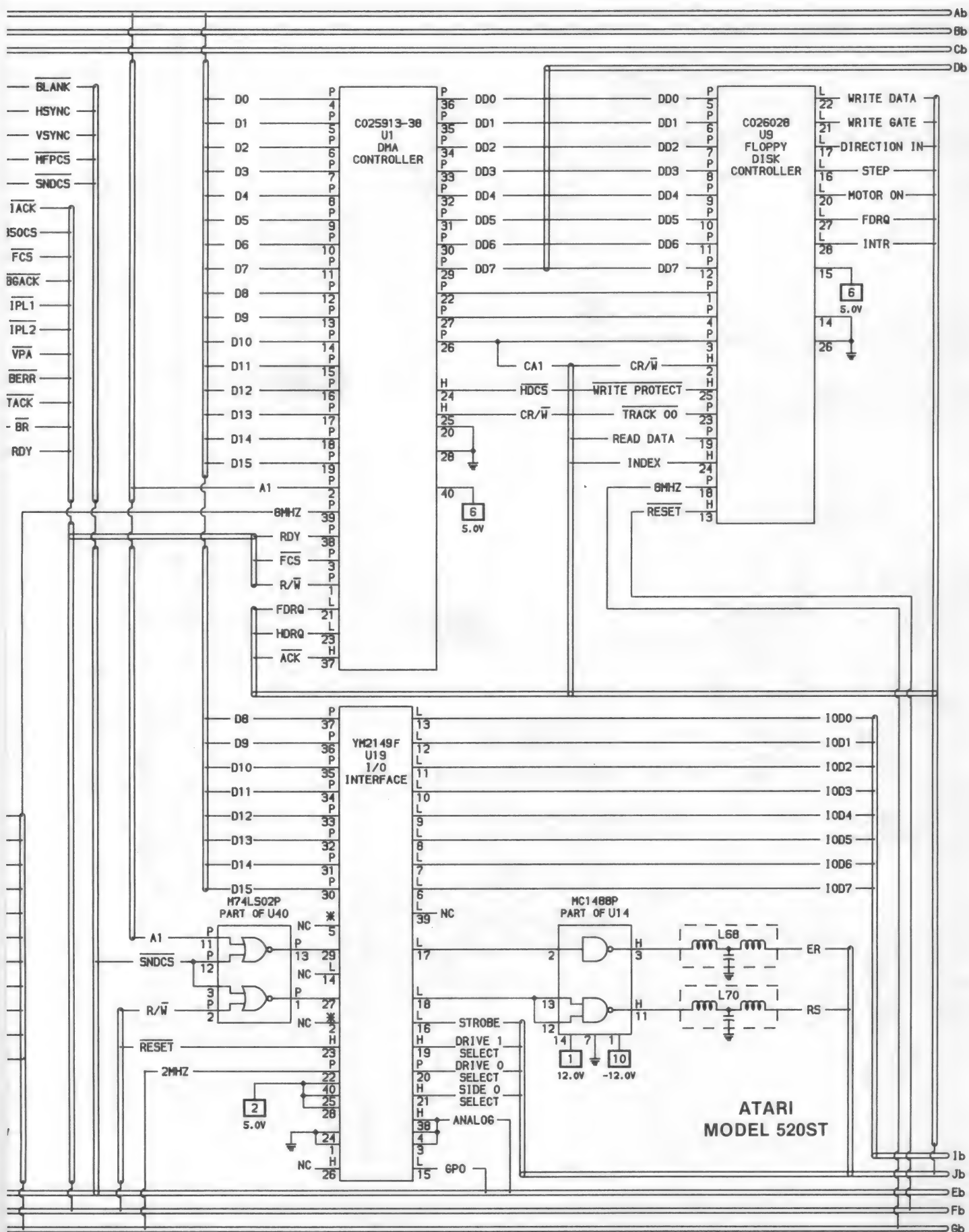
WITH **CIRCUITRACE™**

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## PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Computer malfunctions.

Check all interconnecting cables for good connection and correct hookup before making service checks.

Disconnect all peripherals except the Monitor from the Computer to eliminate possible external malfunctions.

## TEST EQUIPMENT AND TOOLS

### TEST EQUIPMENT

Digital Volt/Ohm Meter  
Logic Probe

### TOOLS

Low Wattage Soldering Iron  
Desoldering Equipment  
Head Cleaning Equipment  
Switch Cleaner (non-spray type)  
Phillips Screwdriver  
Flat Blade Screwdriver  
Long Nose Pliers

## REPLACEMENT PARTS AND DESCRIPTION

ITEM	PART NO.	DESCRIPTION
------	----------	-------------

	C070091-3(1)	Power Supply
--	--------------	--------------

### MONITOR

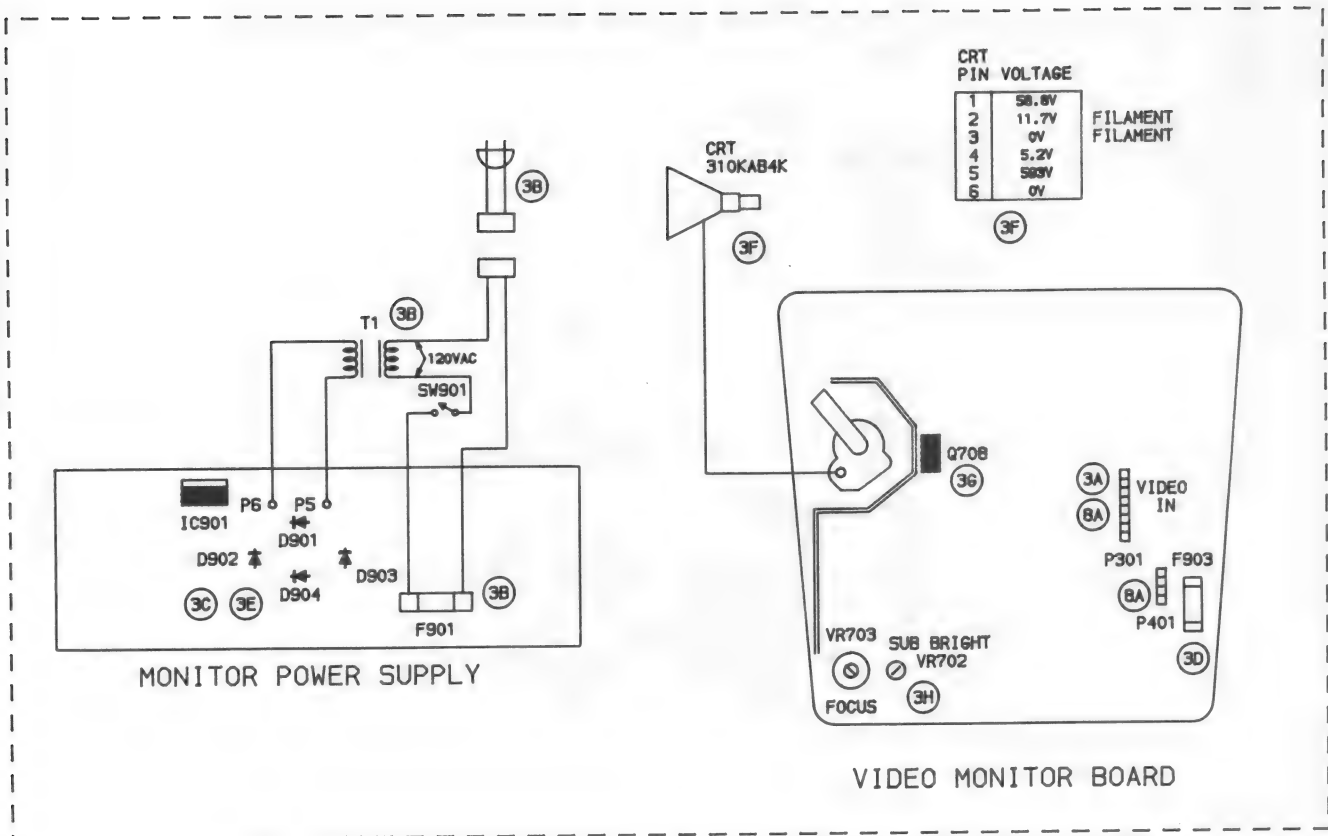
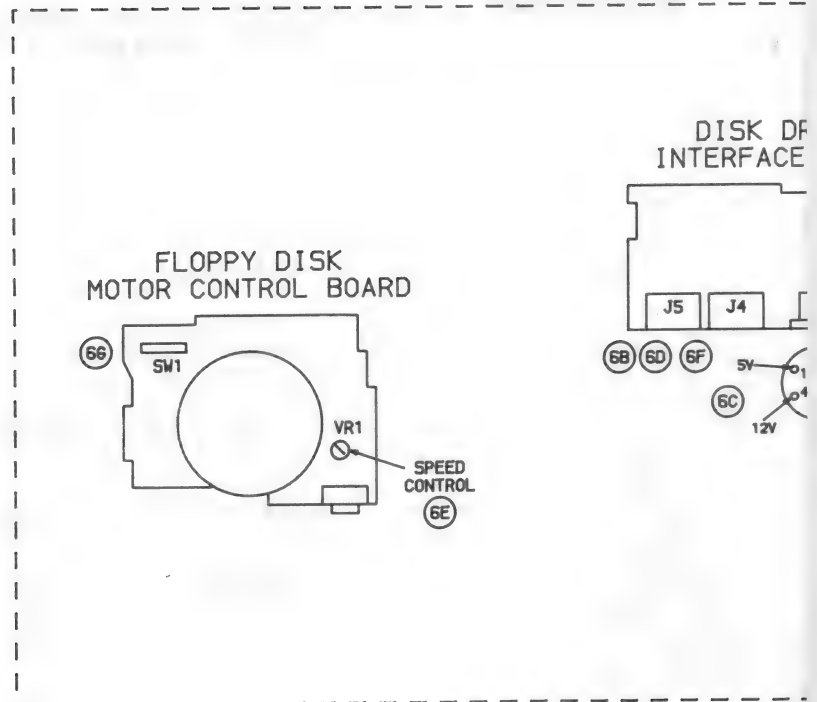
D901 thru D904		Rectifier Diode, 1N5402
F901		Fuse, .7A @ 250V
F903		Fuse, 2A @ 125V
IC901		Voltage Regulator, MC78T12CT
Q708		Horizontal Output Transistor, BU806
SW901		Power Switch
T901		Power Transformer

### SYSTEM BOARD

SW		Power Switch
U1	C025913-38(1)	IC, DMA Controller
U4	C026034-01(1)	IC, ROM
U7	C026035-01(1)	IC, ROM
U12	C025915-38(1)	IC, GLUE
U15	C025912-38(1)	IC, Memory Management Unit
U31	C025914-38(1)	IC, Video Shifter
Y1		Crystal, 2.4576MHz
Y2		Crystal, 32.0424MHz

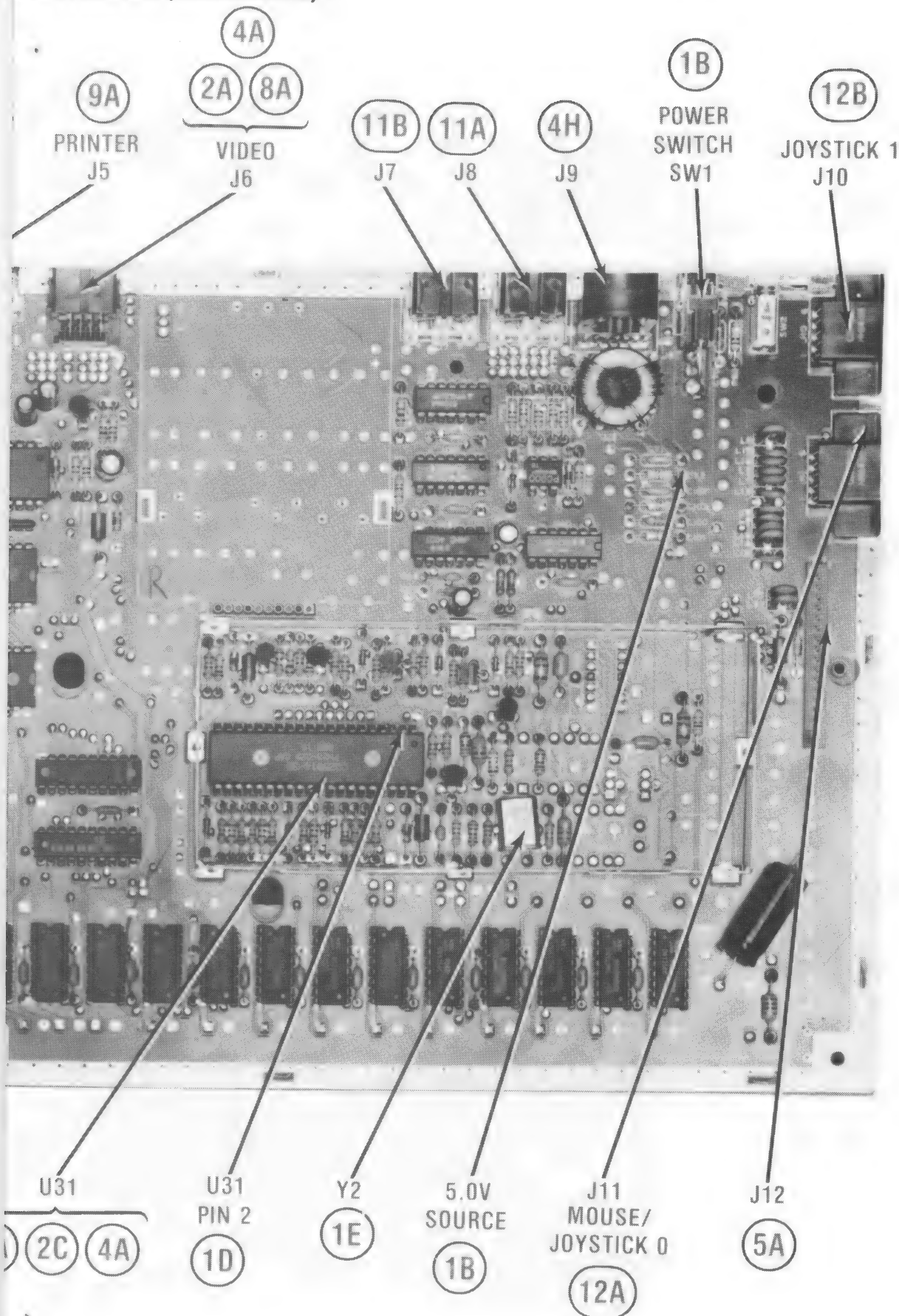
(1) Number on Unit

# PRELIMINARY SERVICE



## INTERCONNECTING DIAGRAM

# E CHECKS (Continued)



CSCS12

ATARI  
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SYSTEM BOARD



HORIZ  
OUTPUT  
Q708  
(3G)

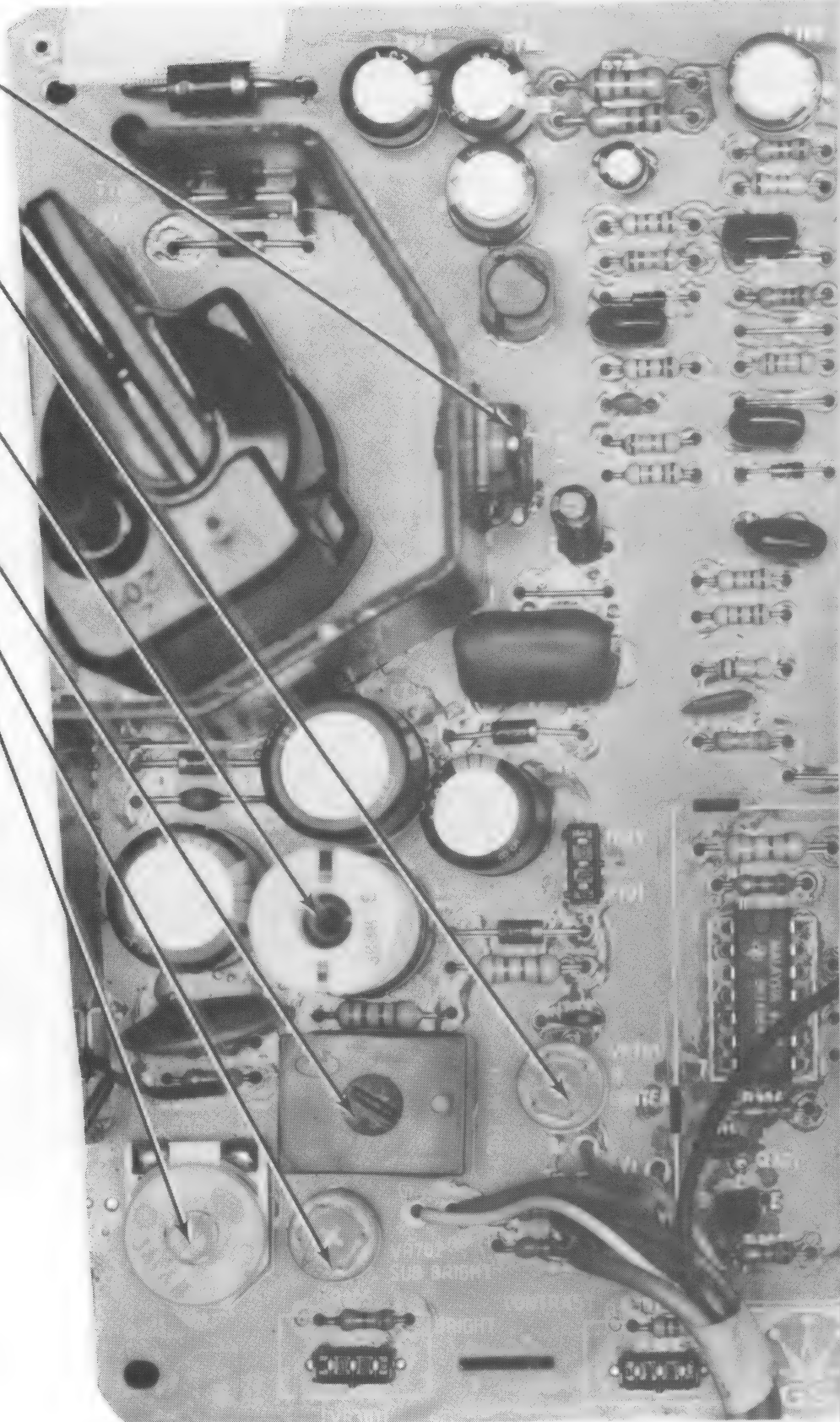
HORIZ  
CENTERING  
VR701

HORIZ  
SIZE  
L702

HORIZ  
LINEARITY  
L703

(3H) VR702

FOCUS



# PRELIMINARY SERVICE CHECKS (Continued)

## SERVICE CHECKS

MATCH THE NUMBERS ON THE INTERCONNECTING DIAGRAM AND PHOTOS WITH THE NUMBERS ON THE SERVICE CHECKS TO BE PERFORMED.

### 1 COMPUTER DEAD

- (A) Unplug Power Supply from Computer and check for 5V between pins 1 and 3 of Power Supply Plug (P9). If 5V is missing, replace or repair Power Supply.
- (B) If 5V is present at Plug P9, reconnect Power Supply. Turn Computer On, check for 5V at junction of Capacitors C71 and C72. If voltage is missing, check Power Switch (SW1).
- (C) Check clock signal at pin 20 of Memory Management Unit IC (U15). If clock signal is missing at pin 20 of IC U15, check clock signal at pin 5 of IC U15. If clock signal is present at pin 5 of IC U15, check IC U15 by substitution.
- (D) If clock signal is missing at pin 5 of IC U15, check clock signal at pin 2 of Shifter IC (U31). If clock signal is present at pin 5 of IC U15, check IC U15 by substitution.
- (E) If signal is missing at pin 2 of IC U31, check Crystal Y2.
- (E) If Fuse F903 is good, check Power Transformer (T1) for an open winding. Also check Diodes D901 thru D904 and Regulator IC (IC901).
- (F) Check voltages on CRT socket and on HV anode. Make sure that the CRT socket is making good contact with the CRT pins, especially pins 2 and 3. If CRT voltages are normal, check CRT with a CRT tester.
- (G) If there is no high voltage at the HV anode, check Horizontal Output Transistor (Q708).
- (H) Check adjustment of Sub-Brightness Control (VR702).

### 2 VIDEO DISPLAY (Computer)

- (A) No video. Check Video Connector (J6). Check Shifter IC (U31) and GLUE IC (U12) by substitution.
- (B) Random dots and/or bars displayed on Monitor screen. Check ROM IC's (U4 and U7) and Memory Management Unit IC (U15) by substitution.
- (C) Scrambled Monitor screen. Check GLUE IC (U12) and Memory Management Unit IC (U15) by substitution. Check Shifter IC (U31) by substitution.

### 3 VIDEO DISPLAY (Monitor)

- (A) No video, check Connector P301 on Video Monitor board. Check video interface cable.
- (B) Turn Monitor On. Check for 120VAC across primary winding of Power Transformer (T1). If 120VAC is missing, check Fuse F901, Monitor Power Switch (SW901), and Monitor power cord.
- (C) If Fuse F901 is open, check Diodes D901 thru D904 and Regulator IC (IC901) on Monitor Power Supply board for possible shorts.
- (D) If 120VAC is present across primary winding of Power Transformer T1, check Fuse F903. If fuse is open, check for possible short on load side of power supply. If no short is found, replace Fuse F903.

### 4 COLOR

- (A) Missing color. Check Shifter IC (U31) by substitution. Check Connector J6 for good connections.

### 5 KEYBOARD

- (A) If Keyboard is dead or a group of keys do not work, check Connector J12 on the System board for good connections. Also check for broken wires between Keyboard Connector J12 and the Keyboard.

(B) Check Keyboard by substitution.

### 6 DISK DRIVE

#### WARNING

It is possible for a defective Disk Drive to write on or erase information on a diskette even when the diskette is write protected. Check a questionable Disk Drive by first using a diskette containing programs that have been duplicated on another diskette.

- (A) Drive motor will not turn On. Check for a logic Low at pin 12 of IC U8 while attempting to read data from the Disk Drive. If pin 12 of IC U8 does not read logic Low, check DMA Controller IC (U1) by substitution.
- (B) If pin 12 of IC U8 is logic Low when attempting to read data from Disk Drive, check Connector J5 on Disk Drive and Connector J3 on System board. Also check Disk Drive Interface cable.
- (C) Check for 5V at pin 1 and 12V at pin 4 of Connector J3 on Disk Drive. If either voltage is missing, check Disk Drive Power Supply by substitution.
- (D) Disk Drive operation is erratic. Check Connector J3 on System board and Connector J5 on Disk Drive for good connections.

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## PRELIMINARY SERVICE CHECKS (Continued)

### SERVICE CHECKS

(E) Clean the Read/Write Head and check Spindle Speed Adjustment (VR1), see "Miscellaneous Adjustments".

(F) Will not read or write. Check Connector J3 on System board and Connector J5 on Disk Drive for good connections. Check Connector J6 on the Disk Drive Analog board for good connections. Check DMA Controller IC U1 on System board by substitution.

(G) Writes on a write protected diskette. Check for a logic Low on pin 14 of Connector J3 on System board with a Write protected diskette inserted in the Disk Drive. If pin 14 of J3 is not Low, check Write Protect Switch (SW1) on the Disk Drive.

#### 7 HARD DISK PORT

(A) Computer will not write to or read from a known good Hard Disk and Controller. Check Hard Port Connector (J2) for good connections. Check DMA Controller IC (U1) by substitution.

#### 8 SOUND

(A) No sound. Check Monitor Connector J6 on System board for a good connection at pin 1. Also check Connectors P301 and P401 on Monitor board.

#### 9 PRINTER PORT

(A) Printer Port is not working. Check Printer Connector J5 for good connections.

#### 10 RS232 SERIAL PORT

(A) Serial Port is not working. Check Serial Port Connector J4 for good connections.

(B) Check for 12V at pin 14 of IC U14 and - 12V at pin 1 of IC U14. If either voltage is missing, replace or repair Power Supply.

(C) Check clock signal at pin 17 of Multi Function Peripheral IC (U11). If clock signal is missing at pin 17 of IC U11, check Crystal Y1.

#### 11 MIDI PORTS

(A) Output port is not functioning. Check Connector J8 for good connections.

(B) Input port not functioning. Check Connector J7 for good connections.

#### 12 MOUSE/JOYSTICK PORTS

(A) Mouse Port is not functioning. Check Mouse Port Connector (J11). Check the Keyboard.

(B) Joystick 1 Port is not functioning. Check Joystick Connector (J10). Check the Keyboard.

# PRELIMINARY SERVICE CHECKS (Continued)

## GENERAL OPERATING INSTRUCTIONS

### POWER UP SEQUENCE

Turn On Monitor and Disk Drive. Turn On Computer. Disk Drive will run for a few seconds. After Disk Drive stops running, Monitor will display instructions to insert the System Disk into Disk Drive. After TOS System Disk has been inserted in to Drive, use the Mouse to move the pointer on the OK box and click left Mouse button once. The Busy light on front panel of Disk Drive will come On as the Operating System is loaded into Computer. NOTE: System Disk can also be loaded into Computer by pressing the RETURN key on Keyboard.

### DISK OPERATING SYSTEM (TOS)

When the Operating System has been loaded into Computer, the Monitor will display the Menu Bar along Top of screen and three Icons along left side. Two are Floppy Disk Icons used to control the Disk Drives and the other is a Trash Icon used to erase files from a disk. When two drives are used, Floppy Disk Icon A controls Drive A and Floppy Disk Icon B controls Drive B.

To load a program from a diskette, use the Mouse to move pointer on icon representing the appropriate Disk Drive. Click left Mouse button twice in rapid succession to open Disk Drive. Disk Drive can also be opened by clicking left Mouse button once and then moving pointer up to the File heading on Menu Bar at top of screen. When File window drops down from Menu Bar, move pointer until the word "Open" is shaded and then press left Mouse button once. When Disk Drive opens, icons representing files on the disk will appear on the screen. To open a program file, move pointer on the program icon and click left Mouse button twice. It is also possible to open a program file by clicking left Mouse button once while pointer is on the program icon and then clicking on "Open" after dropping File window down from Menu Bar. NOTE: Programs written in Basic cannot be loaded until the Basic language has been loaded into Computer.

### BASIC

To load Basic language into Computer, remove TOS System disk from Disk Drive after operating system has been loaded into Computer. Insert Basic language disk into Disk Drive and then open drive as described in the "DISK OPERATING SYSTEM" section of the General Operating Instructions. Move pointer to Basic Program icon and load program into Computer. To go from Basic back to TOS Operating System, drop File window down from Menu Bar and select Close Window option.

To load a Basic program from Disk Drive, pull File Window down from Menu Bar and click left Mouse button with pointer on "Open". A list of Basic programs on the Disk will appear in the Item Selector Dialog Box on the screen. Move pointer to desired program and click left Mouse button. When the chosen program title becomes shaded, move pointer to OK box and click left Mouse button again. The program will be loaded into Computer. The program can also be loaded by typing LOAD, the program name and then pressing RETURN.

To save a Basic program on disk, pull File window down from Menu Bar and click left Mouse button with pointer on "Save As" option. Type the name of the program in the Item Selector Dialog Box. Move pointer to OK box and click left Mouse button to save program. The program can also be saved by typing SAVE, the program name and then pressing the RETURN key.

### USING A BLANK DISKETTE

A blank diskette must be formatted before it can be used to save data. To format a diskette, select the Floppy Disk icon for the Disk Drive to be used. Use the pointer to pull down File window from Menu Bar and then select Format option from File menu. The first Format Box will be displayed on the screen. Insert diskette to be formatted into appropriate Disk Drive and click left Mouse button with pointer on the OK box. The Format Dialog Box will be displayed on the screen. Select proper drive option and move pointer to Format box. Click left Mouse button to begin formatting.

To copy TOS operating system onto a blank diskette, insert TOS System diskette into Disk Drive. Select Floppy Disk A icon with the Mouse and drag it on top of the Floppy Disk B icon and then release left Mouse button. A Dialog Box will be displayed warning that copying Disk A to Disk B will erase the information on Disk B. Move pointer to OK box and click left Mouse button. When Diskcopy Box is displayed on the screen, move pointer to the Copy box and click left Mouse button. Follow the prompts displayed on the screen until copying process is completed.

### USING THE KEYBOARD TO CONTROL THE MOUSE POINTER

The Keyboard cursor keys can be used in place of the Mouse to move pointer around the screen. Pressing the ALTERNATE key and any of the cursor keys will move pointer eight pixels. Press the ALTERNATE and SHIFT keys and any of the cursor keys to move the cursor 1 pixel. Pressing the ALTERNATE and INSERT keys has the same effect as clicking the left Mouse key. To "drag" an icon, press the ALTERNATE and INSERT keys and a cursor key at same time.

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## **PRELIMINARY SERVICE CHECKS (Continued)**

### **DISASSEMBLY INSTRUCTIONS**

#### **CABINET REMOVAL**

Remove six Phillips screws from cabinet bottom. Lift cabinet top up to remove.

#### **MAIN BOARD REMOVAL**

Unplug and remove keyboard. Remove three Phillips screws from front of Main board top shield. Straighten eleven metal tabs holding top shield to Main board. Carefully remove shield from top of Main board. Remove three Phillips screws from back of Main board. Lift front of Main board and pull forward until board is free of cabinet. Remove bottom shield from Main board.

#### **KEYBOARD**

Lay Keyboard face down and remove 26 Phillips screws holding Printed Circuit board to Keyboard case. Carefully lift off board. NOTE: Each key has a rubber cup with a contact button mounted in the center. Unless Keyboard is properly supported to prevent any keys from being depressed, the rubber cups will pop out when circuit board is removed. When reassembling Keyboard, it must be properly supported to insert the rubber cups for each key. Carefully position circuit board on bottom of Keyboard assembly and replace 26 Phillips screws.

#### **POWER SUPPLY**

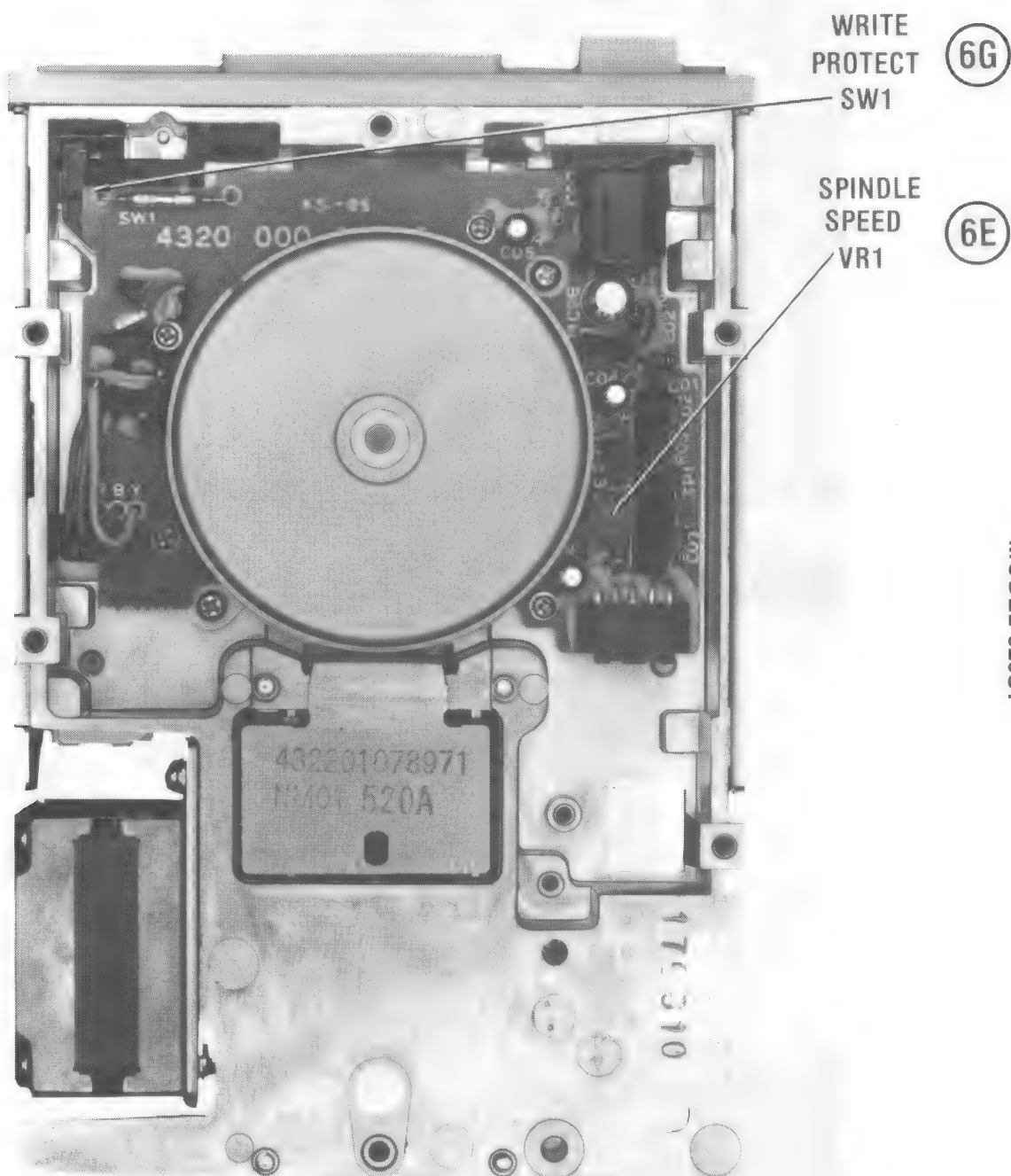
Remove four rubber feet from bottom of Power Supply case by prying them out with a small screwdriver. Remove four, Phillips screws that are exposed when rubber feet are removed. Turn Power Supply upright and lift off top half of case.

#### **DISK DRIVE**

Turn Disk Drive over and remove four Phillips screws from corners of case. Turn Disk Drive upright and remove upper portion of case. Disconnect ribbon cable and power Connector from Analog board. Remove Interface board. Remove three remaining Phillips screws from bottom of case and lift off drive assembly. Remove Phillips screw from each side of drive assembly and slide shield off from the rear.



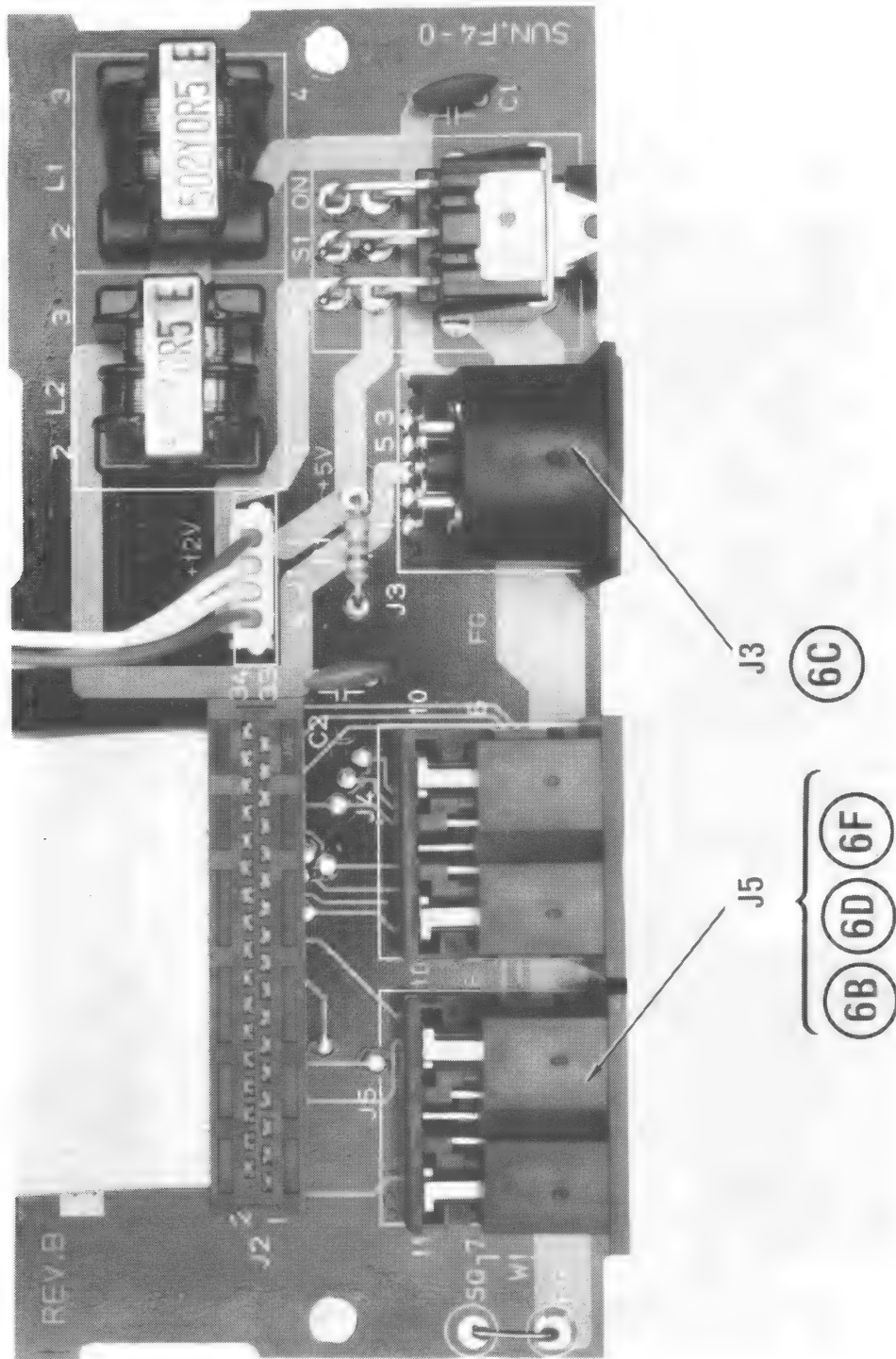
# PRELIMINARY SERVICE CHECKS (Continued)



DISK DRIVE

IX

## PRELIMINARY SERVICE CHECKS (Continued)



DISK DRIVE INTERFACE BOARD

X

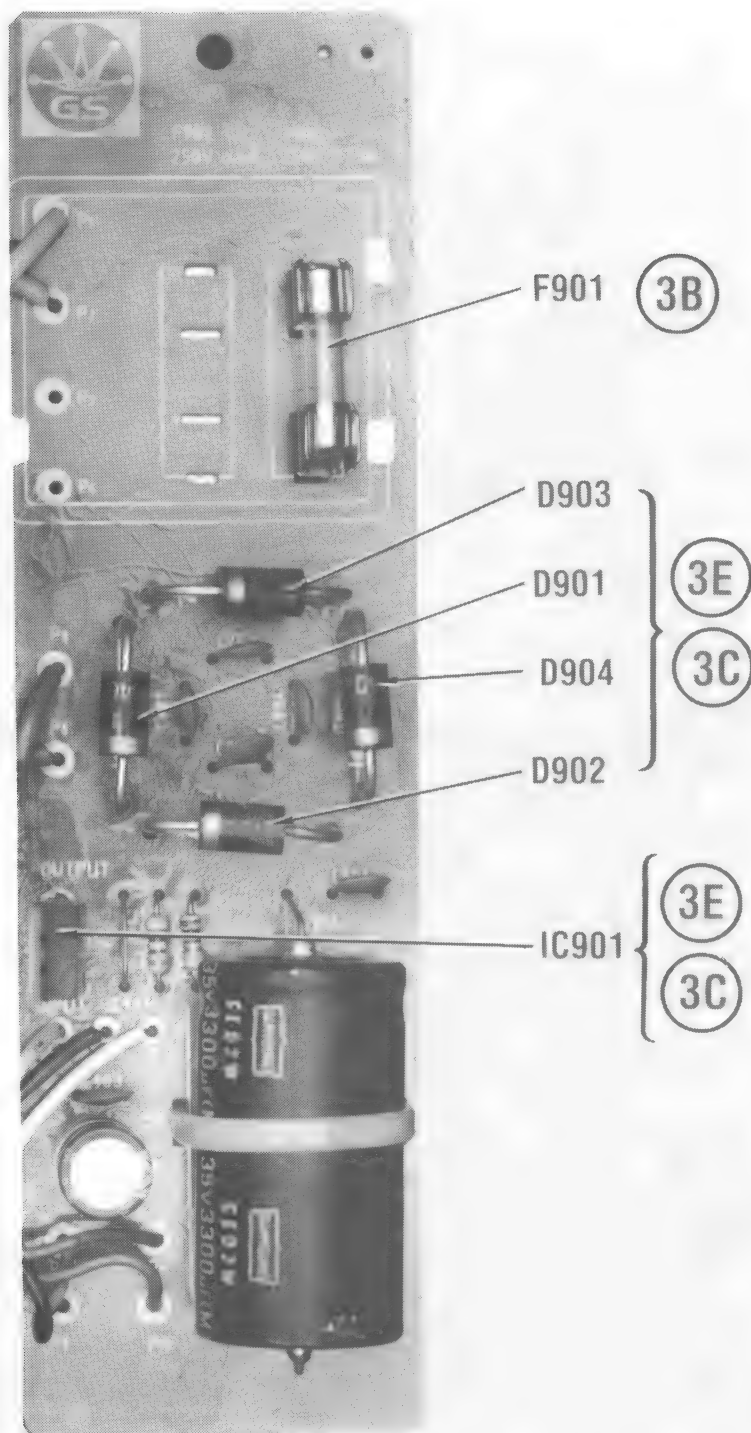
## PRELIMINARY SERVICE CHECKS (Continued)



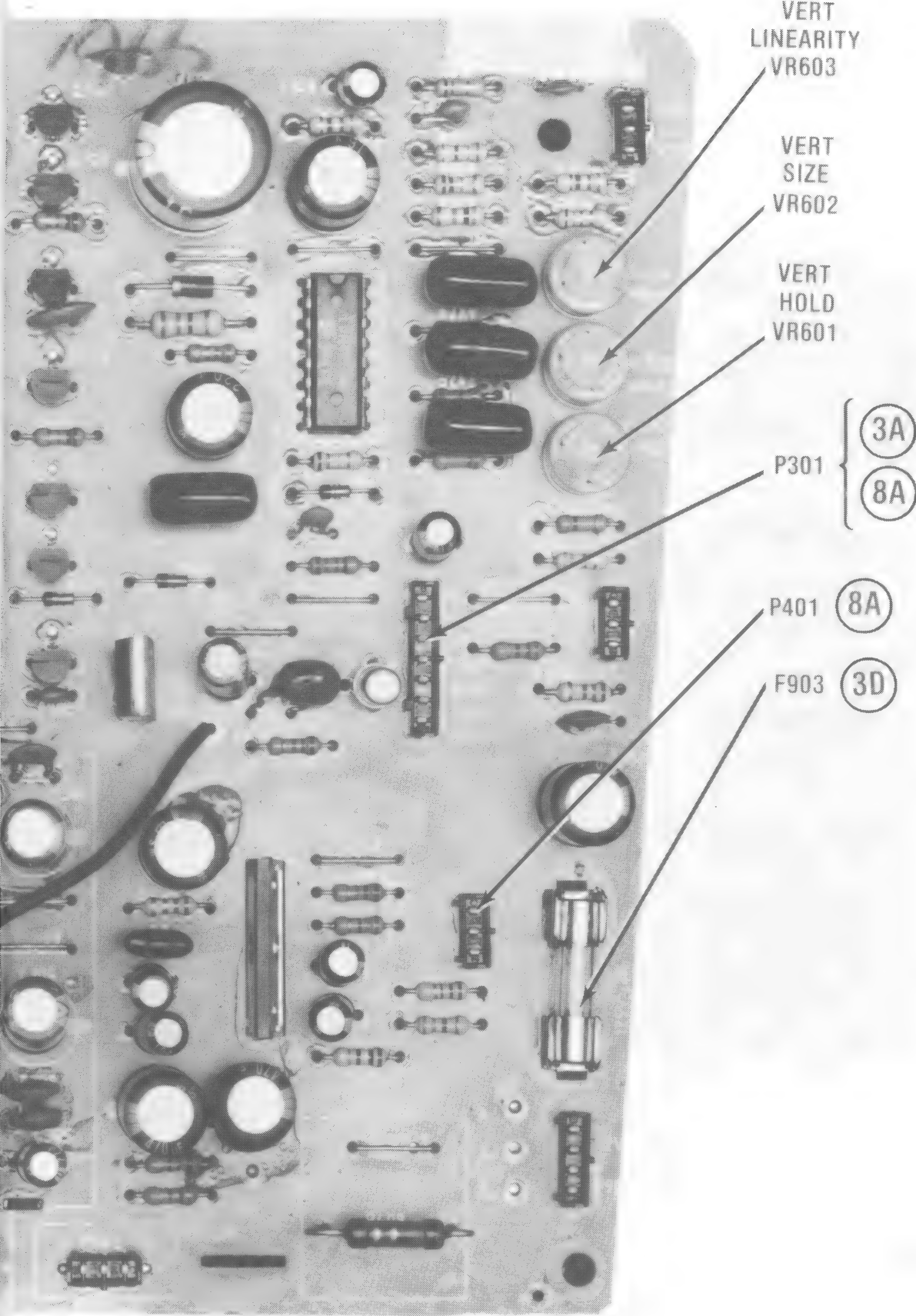
ATARI  
MODEL 520ST

DISK DRIVE BOARD

## PRELIMINARY SERVICE CHECKS (Continued)



CHECKS (Continued)



VERT  
LINEARITY  
VR603

VERT  
SIZE  
VR602

VERT  
HOLD  
VR601

P301

3A

8A

P401

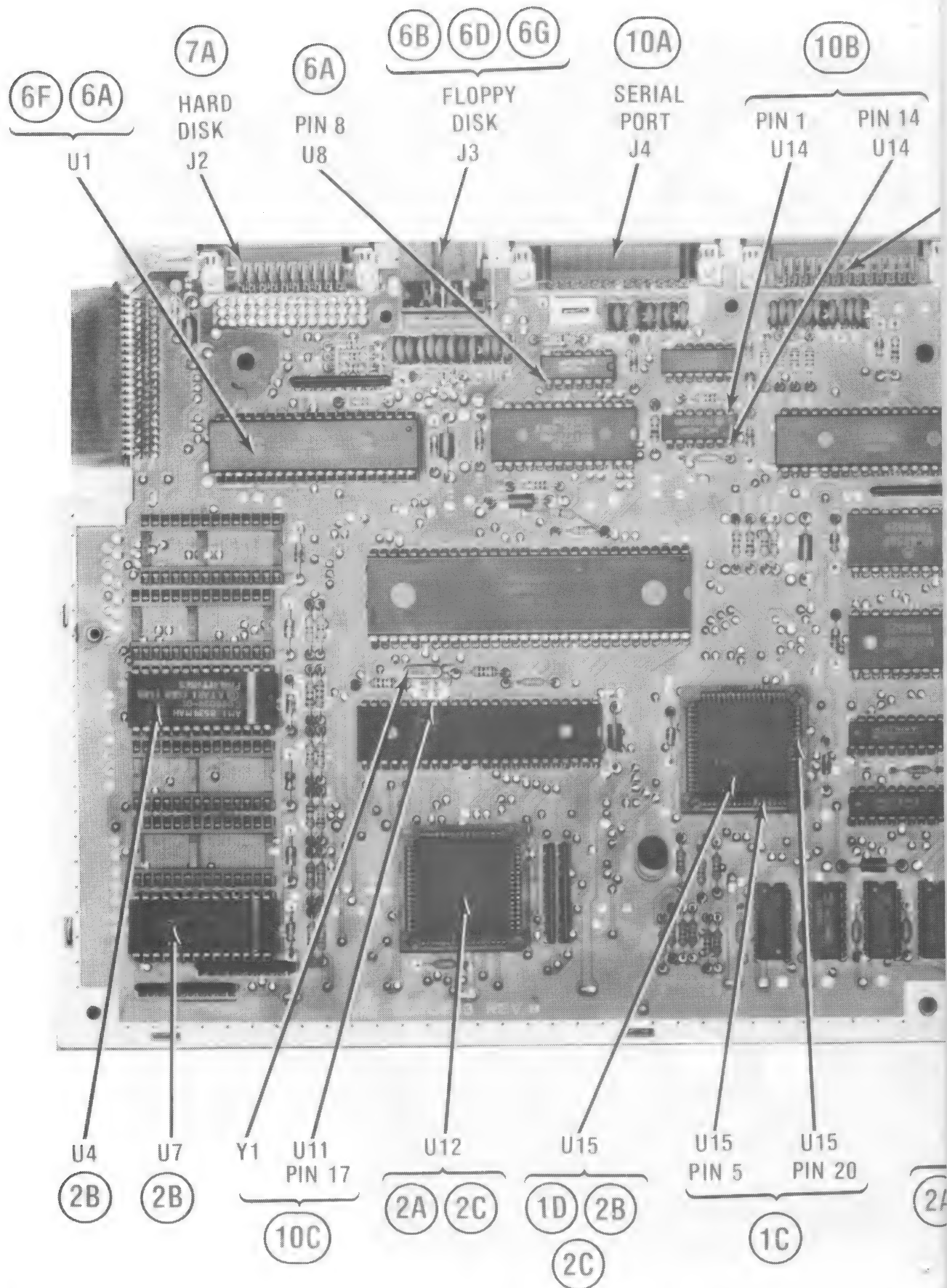
8A

F903

3D

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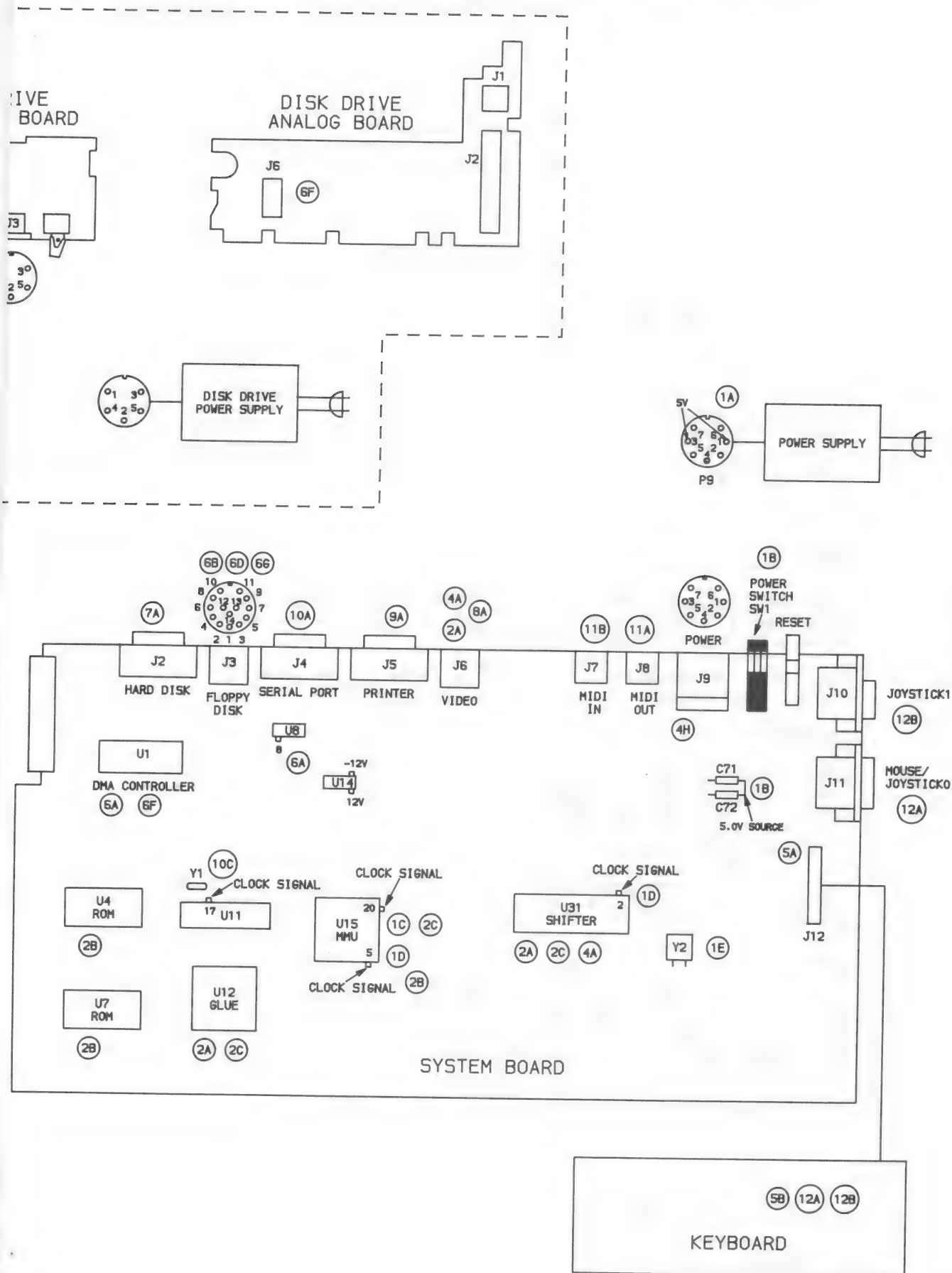




SYSTEM BOARD

XIV

# CHECKS (Continued)



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INTERCONNECTING DIAGRAM

# **PRELIMINARY SERVICE CHECKS (Continued)**

## **PREVENTATIVE MAINTENANCE**

### **ENVIRONMENT**

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of any of the Computer system; Computer, Monitor, Printer, or other power devices.

### **ELECTRICAL POWER**

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptible power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

### **KEYBOARD**

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

### **DISK DRIVES**

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If the disk drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

### **PRINTERS**

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

### **STATIC ELECTRICITY**

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

### **MONITOR**

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

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CSCS12-A

## MONITOR

See Folder CSCS12-B

## KEYBOARD, POWER SUPPLY, SYSTEM BOARD

See Folder CSCS12

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Miscellaneous Adjustments .....	5	Schematic .....	2,11
Parts List .....	6,7	Schematic Notes .....	10
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CSCS12-A

ATARI  
MODEL 520ST



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The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

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## TROUBLESHOOTING

### WARNING

It is possible for a defective Disk Drive to write on or erase information on a write protected diskette. When checking a questionable Disk Drive, make sure that the diskette being used is backed up by at least one duplicate copy.

### CONTINUOUS OPERATION OF DISK DRIVE

The following Basic program can be used to keep the Disk Drive running continuously. This program will also write data on the diskette and read data from the diskette.

```
10 OPEN "O", #1, "SAMS"  
20 FOR X = 1 TO 300  
30 PRINT #1, "HOWARD W. SAMS"  
40 NEXT X  
50 CLOSE #1  
60 GOTO 10
```

### POWER SUPPLY

Connect the external Power Supply to Disk Drive and plug Power Supply unit into an AC outlet. Check for approximately 5.0V at pin 1 and 12.0V at pin 4 of Connector J3 on the Interface Board. If either voltage is missing, replace the Power Supply unit. If the correct voltages are present at pins 1 and 4 of Connector J3, check for 5.0V at pin 1 of Connector J1 on the Analog Control Board. If the voltage is missing at pin 1 of Connector J1, check Power Switch (S1) and Coil L1A. Also check Capacitor C1A on the Interface Board and Electrolytics C1 and C18 on the Analog Control Board for possible shorts.

If 5.0V is present at pin 1 of J1, check for 12.0V at pin 4 of Connector J1. If voltage is missing at pin 4 of J1, check Power Switch S1 and Coil L2A on the Interface Board. Also check Capacitor C2A on the Interface Board and Capacitors C2 and C19 on the Analog Control Board for possible shorts.

### DISK DRIVE WILL NOT RUN

Check for 5.0V at pin 1 and 12.0V at pin 4 of Connector J1. If either voltage is missing, refer to the "Power Supply" section of this Troubleshooting Guide. If the voltages are correct, type in and run the Basic program listed under "Continuous Operation of Disk Drive". While the program is running, check for a logic Low at pin 2 of Connector J7 on the Motor Control Board. If the reading is not Low, check Connector J2 on the Analog Control Board and Connector J7 on the Motor Control board.

If pin 2 of Connector J7 is Low, check for a logic Low on pin 47 of CPU (IC1). If pin 47 of IC1 is not Low, check Connector J5A on the Interface Board and Connector J2 on the Analog Control Board. If pin 47 of IC1 is Low, check Motor Control Board by substitution. If the Disk Drive still does not run, check IC1 or substitute the Analog Control Board.

### HEAD POSITION MOTOR

If the Head Position Motor (M2) is inoperative, check for approximately 5.0V at pin 5 of Connector J5 on the Analog Control Board. If the voltage is missing at pin 5 of J5, refer to the "Power Supply" section of this Troubleshooting Guide. If the voltage is normal at pin 5 of J5, check for pulses at pins 12, 13, 14 and 15 of IC2 while attempting to move the Head back and forth with a disk drive tester. If the

pulses are present at pins 12, 13, 14 and 15 of IC2, check Connector J5 for good connections. Also check the Head Position Motor (M2) winding by measuring the resistance between pin 5 and pins 1, 2, 3 and 4 of Connector J5. Each winding should measure approximately 35 ohms.

If pulses are missing at pins 12, 13, 14 or 15 of IC2, check for pulses at pins 2, 3, 4, and 5 of IC2. If pulses are present at pins 2, 3, 4 and 5 of IC2, check IC2. If pulses are missing at pins 2, 3, 4 or 5 of IC2, check for pulses at pin 49 of IC1. Pin 48 of IC1 should be logic Low when the Head is commanded to move in toward the center of the diskette and logic High when the Head is commanded out toward the edge of the diskette. If the logic readings are correct at pins 48 and 49 of IC1, check IC1 or substitute the Analog Control Board. If the logic readings are not correct at pins 48 or 49 of IC1, check Connector J5A on the Interface Board and Connector J2 on the Analog Control Board.

### WILL NOT READ

Insert a formatted blank diskette in the Disk Drive. Type in and run the Basic program listed under "Continuous Operation of Disk Drive". Use a scope to check for read data at pin 59 of CPU (IC1). If the waveform is missing at pin 59 of IC1, check for the waveform at pin 1 of Connector J5A on the Interface Board. If the waveform is missing at pin 1 of J5A, refer to the "Disk Drive Interface" section of the Computer Troubleshooting Guide. If the waveform is present at pin 1 of J5A, check Connector J5A on the Interface Board and Connector J2 on the Analog Control Board.

If the read data is present at pin 59 of IC1, check the Read/Write head coils and Connector J6. If the Read/Write head coils and Connector J6 check good, check IC1 and associated components or substitute the Analog Control Board.

### WILL NOT WRITE

Verify that the write protect circuit is functioning properly by inserting a diskette that is not write protected. Check for a logic High at pin 42 of CPU (IC1). If pin 42 of IC1 is not High, refer to the "Write Protect Does Not Function" section of this Troubleshooting Guide.

Insert a formatted blank diskette in the Disk Drive. Type in and run the Basic program listed under "Continuous Operation of Disk Drive". With the program running, check for write data pulses at pin 50 of IC1. NOTE: Write data pulses will be present only when the program is writing data on the diskette. If write data pulses are missing at pin 50 of IC1, check for the pulses at pin 11 of Connector J5A on the Interface Board. If the write data pulses are missing at pin 11 of J5A, refer to the "Disk Drive Interface" section of the Computer Troubleshooting Guide. If write data pulses are present at pin 11 of J5A, check Connector J5A on the Interface Board and Connector J2 on the Analog Control Board.

If the data pulses are present at pin 50 of IC1, check the Read/Write head coils and Connector J6. If the Read/Write head coils and Connector J6 check good, check IC1 and associated components or substitute the Analog Control Board.

## TROUBLESHOOTING (Continued)

### INDEX DETECTOR

To verify that the Index Detector Circuits are working, insert a formatted blank diskette in the Disk Drive. Type in and run the program listed under "Continuous Operation of Disk Drive". With the program running, check for pulses at pin 46 of CPU (IC1). If pulses are present at pin 46 of IC1, the Index Detector Circuits are working. Check for index pulses at pin 4 of Connector J5A on the Interface Board. If the pulses are missing at pin 4 of J5A, check Connector J5A on the Interface Board and Connector J2 on the Analog Control Board.

If index pulses are missing at pin 46 of IC1, check for pulses at pin 10 of IC2. If index pulses are present at pin 10 of IC2, check IC1 or substitute the Analog Control Board. If index

pulses are missing at pin 10 of IC2, check for pulses at pin 7 of IC2. If pulses are present at pin 7 of IC2, check IC2. If the pulses are missing at pin 7 of IC2, check the Motor Control Board by substitution.

### WRITE PROTECT DOES NOT FUNCTION

If a write protected disk is being written on, use the following procedure to check the write protect circuit. Insert a write protected diskette in the Disk Drive and check for a logic Low at pin 42 of CPU (IC1). If pin 42 of IC1 is not Low, check the Write Protect Switch on the Motor Control Board or replace the Motor Control Board. If pin 42 of IC1 is Low, check for pulses at pin 58 of IC1. If there are no pulses at pin 58 of IC1, check IC1 or substitute the Analog Control Board.

## DISASSEMBLY INSTRUCTIONS

### DISASSEMBLY INSTRUCTIONS

Turn Disk Drive over and remove four Phillips screws from corners of case. Turn Disk Drive upright and remove upper portion of case. Disconnect ribbon cable and power Connector from Analog board. Remove Interface board. Remove three remaining Phillips screws from bottom of case and lift off drive assembly. Remove Phillips screw from each side of drive assembly and slide shield off from the rear.

## MISCELLANEOUS ADJUSTMENTS

### WARNING

It is possible for a defective Disk Drive to write on or erase information on a diskette even if the diskette is write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless so instructed in the alignment procedures. The test equipment may cause the Disk Drive circuits to erase sections of the alignment diskette even when the diskette is write protected.

### EQUIPMENT REQUIRED

A test program or a Disk Drive Tester is required which will turn On the Disk Drive and step the head to the track specified in the alignment procedures. Use a Dysan Analog Alignment Diskette 350A when an alignment diskette is specified in the alignment procedures. Note: The Dysan Alignment Diskette has only alignment patterns on it and does not contain any alignment programs.

### SPINDLE SPEED ADJUSTMENT

If a Disk Drive Tester which provides a speed readout in rpm is being used, adjust the Spindle Speed Control (VR1) on the Motor Control Board for a speed of 300 rpm.

If a Disk Drive Tester is not available, center and paste the strobe pattern in Figure 1 on the Drive Motor flywheel. Insert a diskette into the Drive. Type in and run the program listed under "Continuous Operation of Disk Drive" to keep the Disk Drive running. Use the outside pattern with 60Hz fluorescent lighting and the inside pattern with 50Hz lighting. Adjust the Motor Speed Control (VR1) on the Motor Control Board until the appropriate strobe pattern appears to stand still.

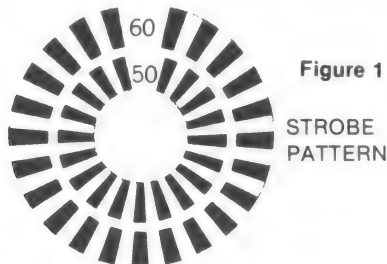


Figure 1

STROBE  
PATTERN

### RADIAL HEAD ALIGNMENT

Connect channel A of a dual trace scope to TP1A, channel B input to TP1C and the external trigger input to pin 4 of Connector J5A on the Interface Board. Set the scope to add mode with one channel inverted, sweep time to 20mSec and voltage range to .2V. Turn On Disk Drive. Insert Alignment Diskette into Drive and step the head to Track 40. The cats-eye pattern shown in Figure 2 should be displayed on the scope.

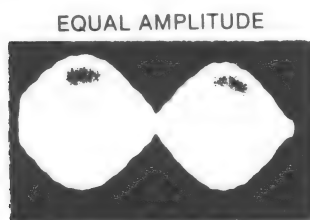


Figure 2

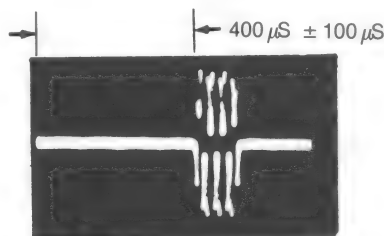


Figure 3

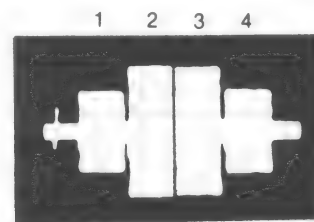


Figure 4

The amplitude of the two lobes displayed in the pattern must be within 60% of each other. If the lobes are out of tolerance, loosen two Phillips screws that mount the Head Stepping Motor to Drive chassis. Insert flat blade screwdriver in the notch at rear of Head Stepping Motor mounting bracket. Use screwdriver to rotate Stepping Motor until the two lobes are equal or within 60% of each other. Retighten the Head Stepping Motor mounting screws and recheck radial alignment by stepping Head to Track 75 and back to Track 40.

### TRACK 00 STOP DETECTOR

Connect a scope probe to TP1A and set sweep time 20  $\mu$ Sec. Set voltage range to .2V. Turn On Disk Drive. Insert Alignment Diskette and set Head to Track 00. A 62.5MHz signal should be displayed on the scope. If the 62.5MHz signal is not present, step head forward or back until the signal is present. When the 62.5MHz signal is displayed on the scope, Head is on Track 00.

With Head set to Track 00, check for a logic High at pin 2 of Connector J4. Move Head to Track 02 and check for a logic Low at pin 2 of Connector J4. If the readings are not correct, set Head to Track 01 and loosen the Track 00 Detector screw, see "Disk Drive Mechanical Photo". Insert a flat blade screwdriver in the Track 00 Detector adjustment slot and adjust the detector until a logic High reading appears at pin 2 of Connector J4. Retighten the Track 00 Detector screw and check for a logic High at pin 2 of J4 when the Head is set to Track 01 and a logic Low when the Head is set to Track 02. If the readings are not correct, repeat the Track 00 Detector adjustment.

### INDEX SENSOR ADJUSTMENT

Connect channel A input of a dual trace scope to TP1A, channel B input to TP1C and the external trigger input to pin 4 of Connector J5A on the Interface Board. Set scope to add mode with one channel inverted, sweep time to 100  $\mu$ Sec and voltage range to .2V. Turn On Disk Drive. Insert Alignment Diskette and set Head to Track 40. Confirm that the timing between the start of the sweep and the first pulse of the timing burst is 400  $\mu$ Sec  $\pm$  100  $\mu$ Sec. See Figure 3.

If the timing is not within tolerance, loosen Phillips screw holding the Index Detector. Adjust the Index Detector until the timing is 400  $\mu$ Sec  $\pm$  100  $\mu$ Sec. Tighten the screw and recheck the index timing at Tracks 2, 40 and 79.

### AZIMUTH ADJUSTMENT

Connect channel A input of a dual trace scope to TP1A, channel B to TP1C and external trigger input to pin 4 of Connector J5A. Set sweep time to .5mSec and voltage range to .2V. Set scope to add mode with one channel inverted. Turn On Disk Drive. Insert Alignment Diskette and set Head to Track 40. The pattern shown in Figure 4 should be displayed on the scope. The amplitude of bursts 1 and 4 must be equal to or less than the amplitude of bursts 3 and 4.

## ° PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

### SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			NOTES	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
DISK DRIVE D2,3 D98,99 IC1 IC2	M51017AP M54539P			NTE519 NTE519	ECG519 ECG519	SK3100/519 SK3100/519	WEP925/519 WEP925/519	103-131 103-131

## PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
RA1 R3,R4 R22 R99	DISK DRIVE LOGIC BOARD  Resistor Network 470 1% 1/8W Carbon Film 36K 1% 1/8W Carbon Film 2700 1% 1/4W Carbon Film			

### COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
L1 L2	DISK DRIVE  RF Choke RF Choke	

ITEM No.	FUNCTION	MFGR. PART No.
L3 L1A L2A	RF Choke Filter Filter	

### MISCELLANEOUS

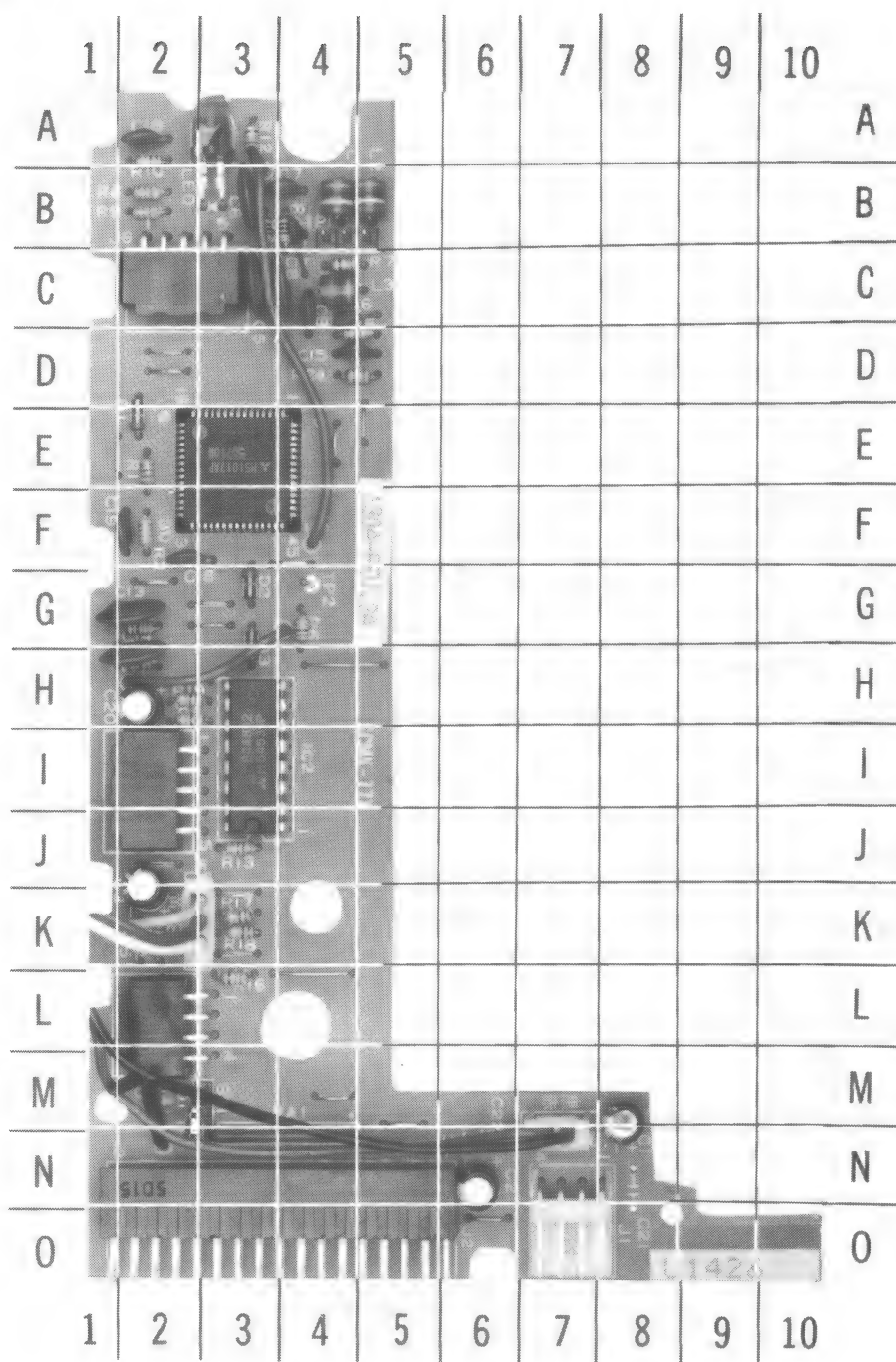
ITEM No.	PART NAME	MFGR. PART No.	NOTES
Head 0 LED1 M1 M2 S1	DISK DRIVE  Head LED Sensor Motor Switch		Read/Write/Erase Activity Track 0 Head Position Power

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MODEL 520ST



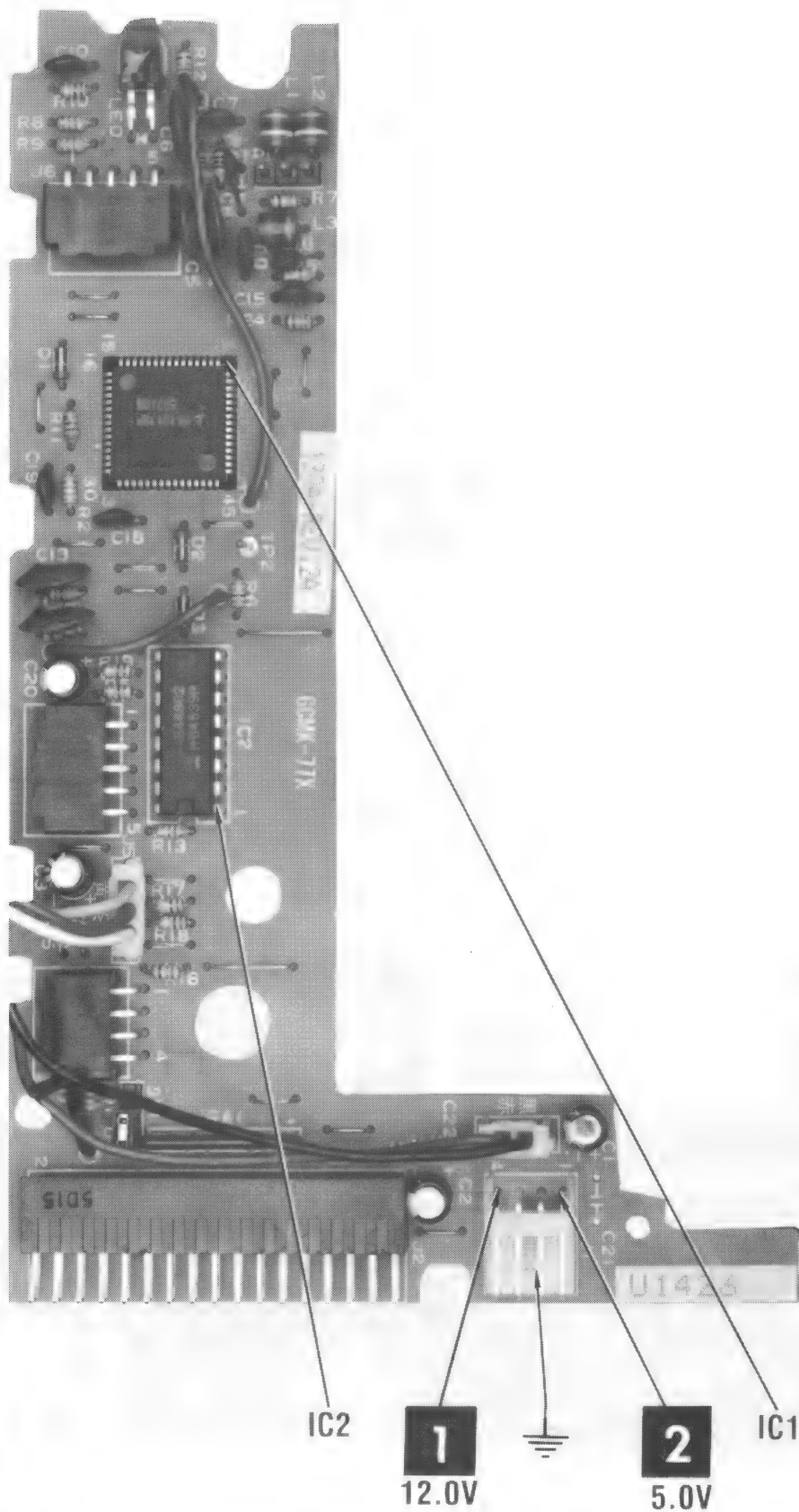
# GridTrace LOCATION GUIDE

C1	M-8
C2	N-6
C3	K-2
C4	C-4
C5	C-3
C6	B-3
C7	B-4
C8	B-4
C9	C-4
C10	A-2
C13	G-2
C14	H-2
C15	D-4
C16	C-4
C18	F-2
C19	F-2
C20	H-2
D1	E-2
D2	G-3
D3	G-3
D98*	N-5
D99*	N-4
IC1	E-3
IC2	I-3
J1	O-7
J2	N-4
J4	L-2
J5	I-2
J6	C-2
L1	B-4
L2	B-5
L3	C-4
LED	A-3
R1	K-2
R2	F-2
R3	B-3
R4	B-4
R5	H-2
R6	G-4
R7	C-4
R8	B-2
R9	B-2
R10	A-2
R11	E-2
R12	A-3
R13	J-3
R15	K-2
R16	L-3
R17	K-3
R18	K-3
R19	H-2
R22	G-2
R23	H-2
R24	D-4
R25	D-5
R96*	N-5
R97*	M-3
R98*	M-3
R99*	L-2
RA1	N-4
SS1	M-3
TP1A	B-4
TP1B	B-4
TP1C	B-5
TP2	G-4



\* Located on bottom of board.

ATARI  
MODEL 520ST



NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED.

## SCHEMATIC NOTES

- See parts list
- ⊥ Ground
- ⏏ Chassis

Voltages, waveforms and logic probe readings taken on Disk Drive while running the following program. Readings taken while the Head Position Motor (M2) is operating unless otherwise noted. A formatted diskette containing no data was used in the Disk Drive. The diskette was not write protected.

```

10 OPEN "O",#1,"SAMS"
20 FOR X=1 TO 300
30 PRINT #1,"HOWARD W. SAMS"
40 NEXT X
50 CLOSE #1
60 GOTO 10
    
```

Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

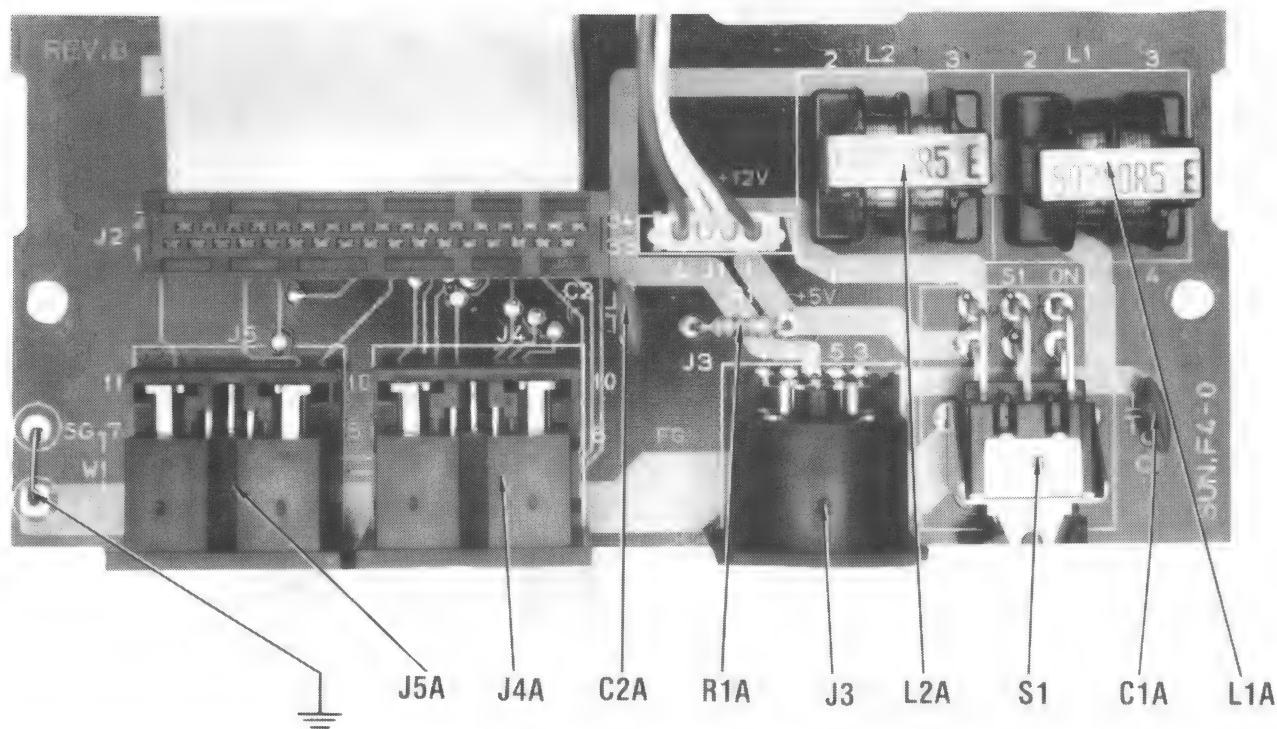
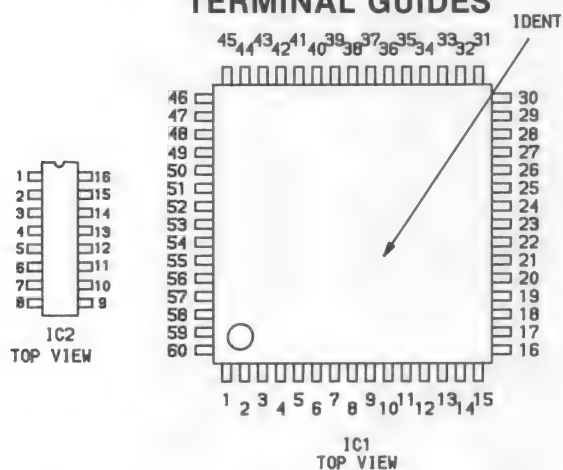
Electrolytic capacitors are 50 volts or less, 20% unless noted.

Resistors are 1/2W or less, 5% unless noted.

Value in ( ) used in some versions.

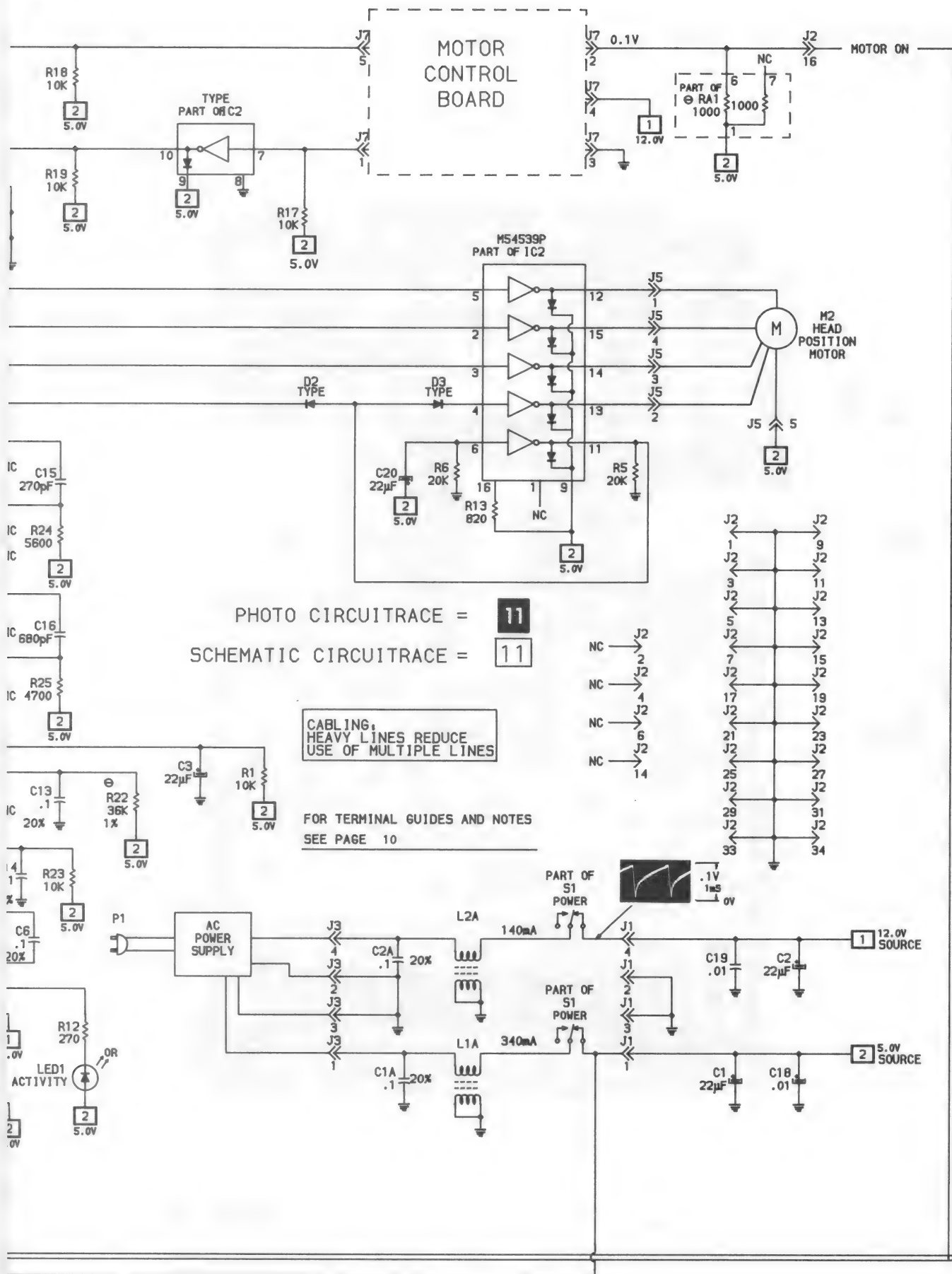
Measurements with switching as shown, unless noted.

## TERMINAL GUIDES

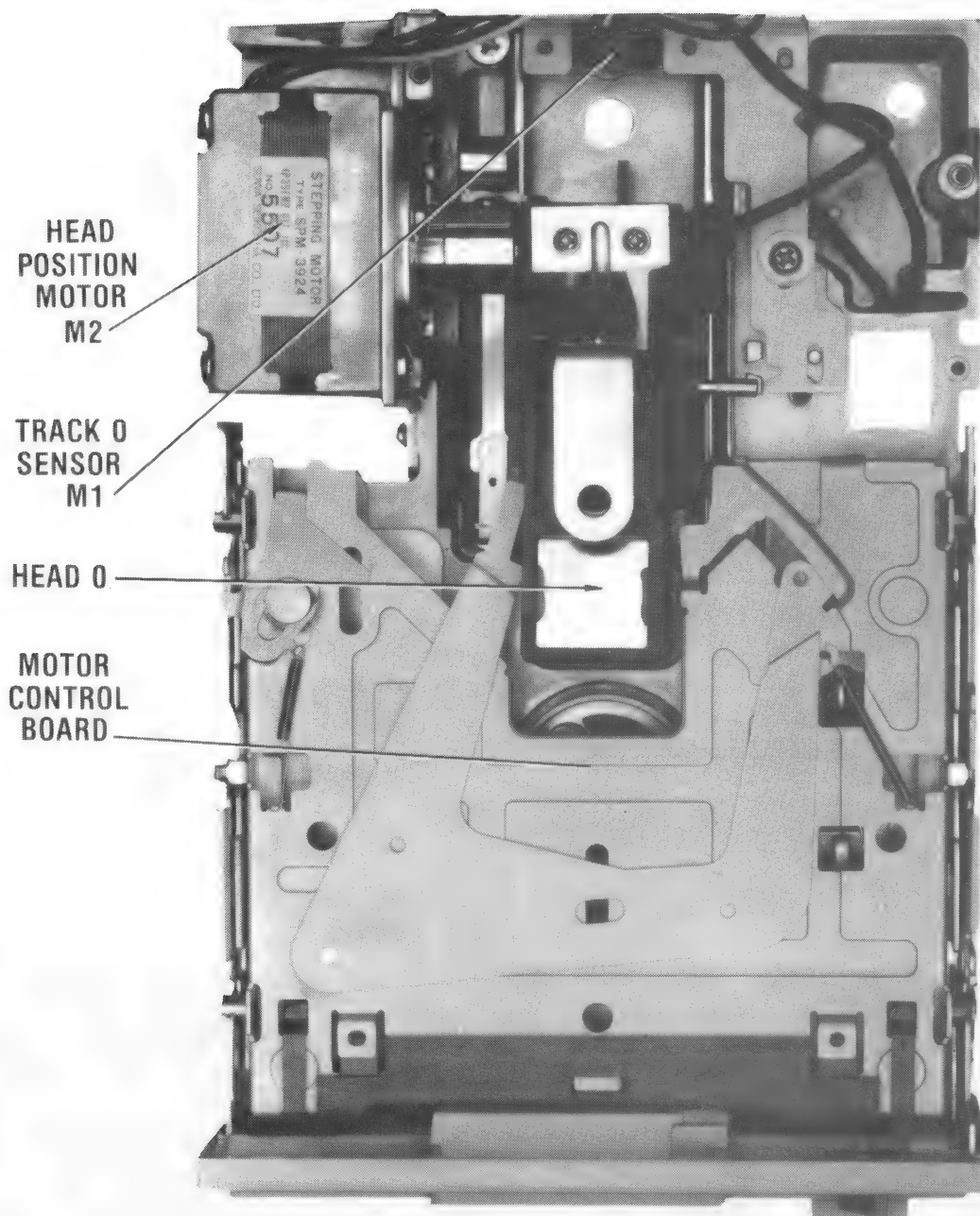


DISK DRIVE INTERFACE BOARD

# MOTOR CONTROL BOARD



ATARI  
MODEL 520ST



CHASSIS-TOP VIEW



ATARI  
MODEL 520ST**CSCS12-B****KEYBOARD, POWER SUPPLY,  
SYSTEM BOARD**

See Folder CSCS12

**DISK DRIVE**

See Folder CSCS12-A

**CSCS12-B**ATARI  
MODEL 520ST**INDEX**

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**SAMS**™ **Howard W. Sams & Co.**  
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

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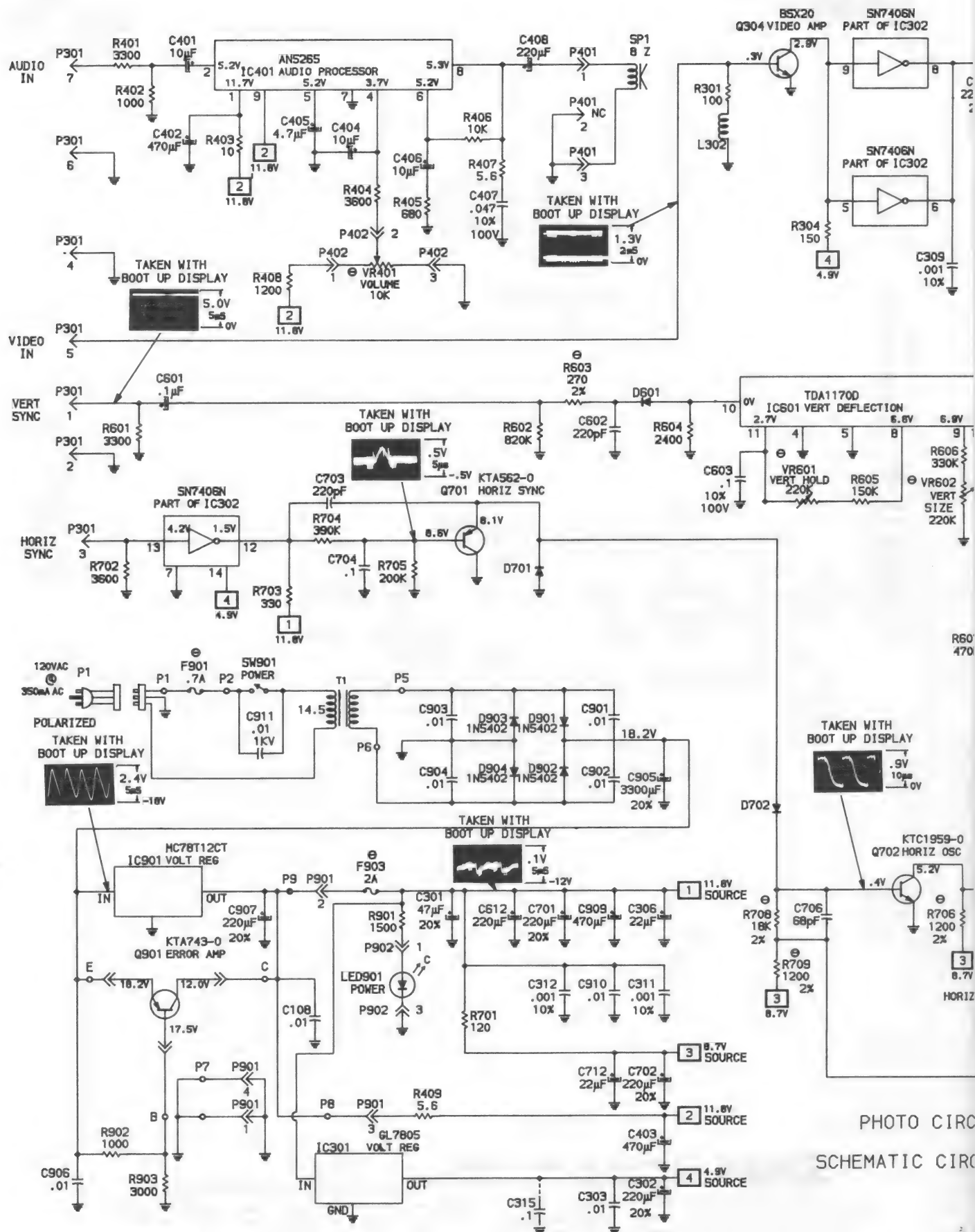


PHOTO CIRC  
SCHEMATIC CIRC

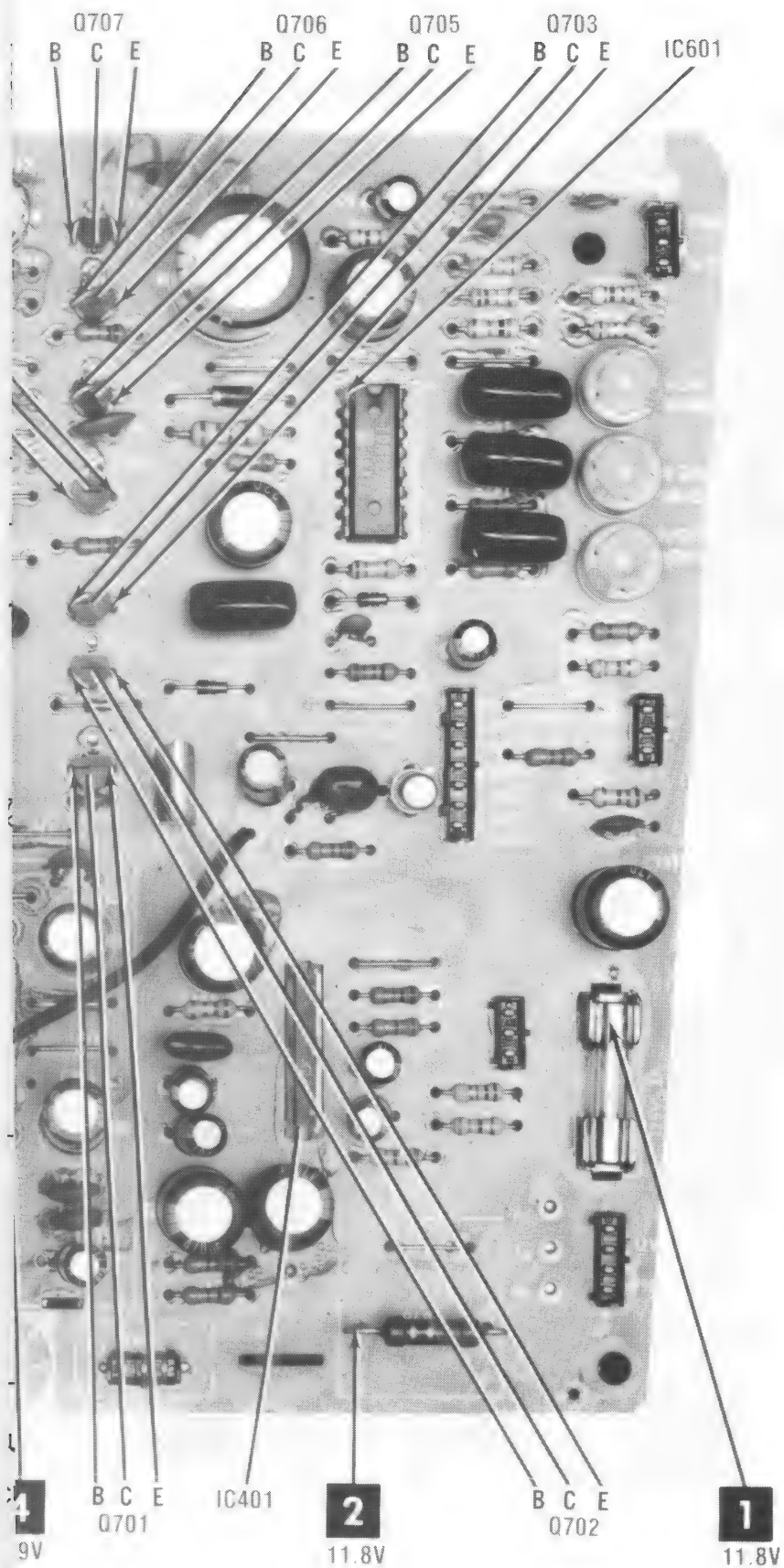
A PHOTOFACIT STANDARD NOTATION SCHEMATIC

WITH **CIRCUITRACE**

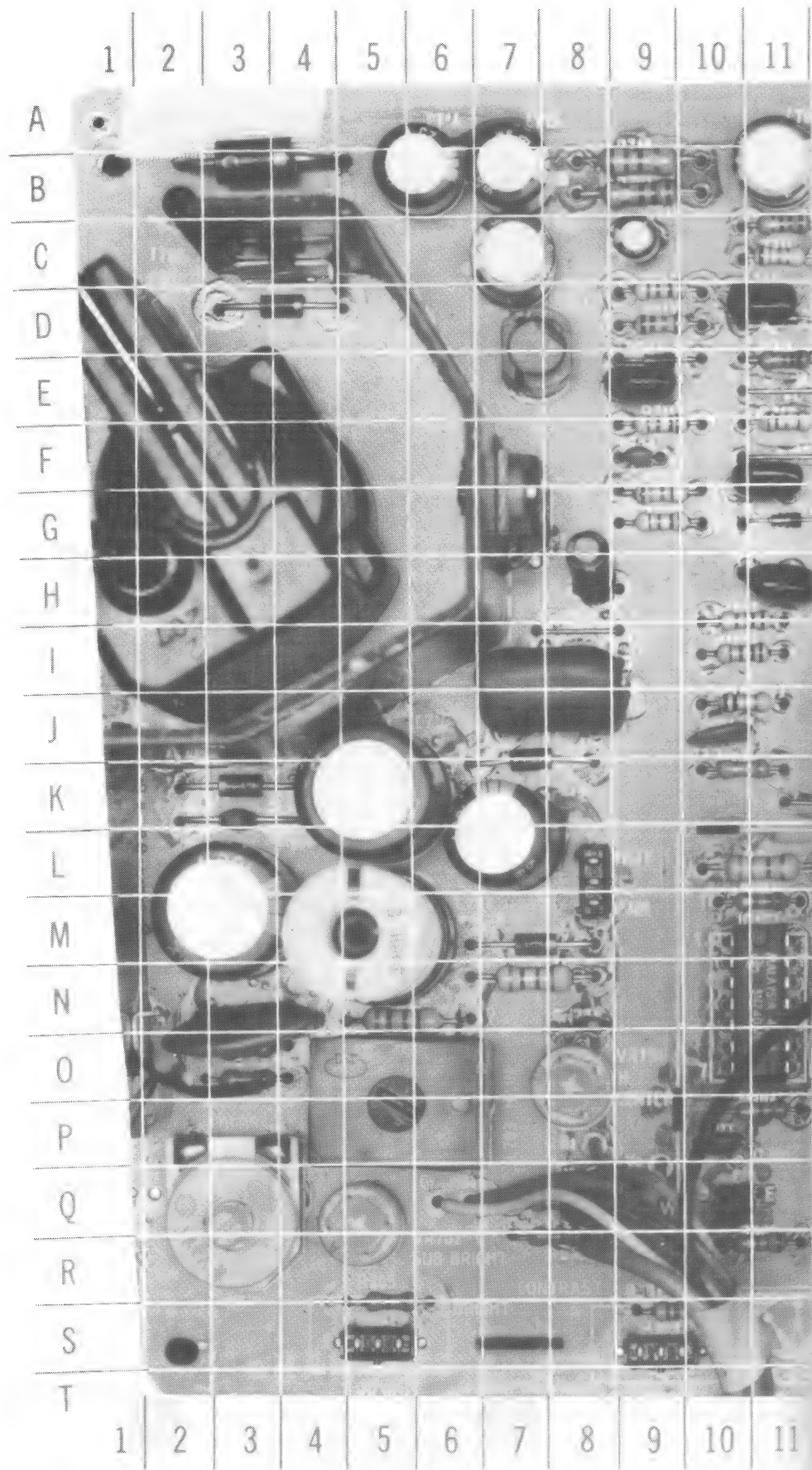
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# CSCS12-B

ATARI  
MODEL 520ST



MAIN BOARD



**MAIN BOARD**

A Howard W. Sams **GRIDTRACE™** Photo

# MAIN BOARD GridTrace LOCATION GUIDE

C301	J-15	P302	S-5	R726	Q-3
C302	M-12	P303	S-9	R727	O-3
C303	L-12	P401	N-19	R901	K-21
C304	O-12	P402	S-13	T701	F-3
C305	R-12	P601	B-21	TH701	N-8
C309	Q-12	P701	L-8	VR601	G-21
C310	Q-12	P901	R-20	VR602	F-21
C311	P-10	P902	J-21	VR603	D-21
C401	P-17	Q301	Q-10		
C402	Q-14	Q304	K-18		
C403	Q-16	Q701	J-13		
C404	P-14	Q702	I-13		
C405	O-14	Q703	H-13		
C406	O-17	Q704	F-13		
C407	N-14	Q705	E-13		
C408	M-15	Q706	C-13		
C601	H-19	Q707	B-13		
C602	H-17	Q708	G-7		
C603	G-19	R301	K-16		
C604	E-19	R304	M-11		
C605	F-19	R305	R-5		
C606	B-19	R306	P-11		
C607	B-20	R307	S-9		
C608	B-17	R308	R-11		
C609	H-15	R309	J-5		
C610	C-15	R401	P-18		
C611	F-15	R402	O-18		
C612	C-17	R403	P-17		
C701	C-7	R404	R-14		
C702	B-11	R405	N-17		
C703	K-13	R406	N-17		
C704	J-10	R407	N-14		
C705	H-11	R408	R-14		
C706	F-9	R409	S-18		
C707	F-11	R601	I-20		
C708	E-9	R602	H-20		
C709	D-11	R603	I-17		
C710	E-13	R604	F-19		
C711	C-9	R605	E-17		
C712	H-8	R606	G-19		
C713	I-8	R607	E-19		
C714	K-5	R608	D-19		
C715	B-7	R609	C-19		
C716	B-6	R610	B-19		
C717	M-3	R611	B-17		
C718	L-7	R612	C-19		
C719	N-3	R613	C-28		
C908	L-1	R614	D-21		
C909	L-21	R615	F-15		
C910	K-21	R616	E-15		
D601	H-17	R701	B-19		
D602	E-15	R702	J-20		
D701	I-14	R703	L-11		
D702	I-13	R704	K-10		
D703	G-11	R705	J-10		
D704	E-9	R706	I-10		
D705	D-11	R707	H-10		
D706	I-8	R708	G-9		
D707	B-3	R709	G-9		
D708	D-4	R710	G-13		
D709	M-7	R711	F-9		
D710	K-3	R712	D-9		
D711	K-7	R713	F-11		
D712	K-3	R714	E-11		
F903	O-20	R715	D-9		
IC301	J-14	R716	C-11		
IC302	N-11	R717	D-13		
IC401	N-16	R718	O-11		
IC601	E-17	R719	B-9		
L302	K-16	R721	N-7		
L701	D-7	R722	N-5		
L702	M-15	R723	R-8		
L703	P-5	R724	O-3		
P301	J-18	R725	Q-5		

**CSCS12-B**  
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MODEL 520ST



## TROUBLESHOOTING

### POWER SUPPLY

Check for 18.2V at Cathode of D901. If voltage is missing, check Fuse F901. If F901 is open, check Diodes D901 thru D904, Electrolytic C905 and Voltage Regulator IC (IC901) for possible shorts. If Fuse F901 is good, check Power Transformer (T1), Power Switch (SW901) and Power Cord (P1). If voltage at Cathode of D901 is low, check Diodes D901 thru D904 and Electrolytic C905.

If voltage is normal at the Cathode of D901, check for 11.8V on the output side of Fuse F903. If the voltage is missing, check Fuse F903. If Fuse F903 is open, check for a possible short on the load side of the power supply. If F903 is good, check Voltage Regulator IC (IC901). If 11.8V is present at the output side of F903, check for 4.9V at the OUTPUT pin of Voltage Regulator IC (IC301). If 4.9V is missing, check IC301.

### HORIZONTAL

If there is no high voltage, inject a horizontal drive signal at base of Horizontal Output Transistor (Q708). If high voltage returns, check waveform at base of Horizontal Drive Transistor (Q707). If waveform is present at base of Q707, check Q707, Resistor R719 and Electrolytic C711. If waveform is missing at base of Q707, check waveform at base of Q705. If waveform is present at base of Q705, check Q705, Q706 and their associated components. If waveform is missing at base of Q705, check Horizontal Oscillator Transistors Q702 and Q703 and their associated components.

If high voltage does not return when a horizontal drive signal is injected at base of Horizontal Output Transistor (Q708), check Q708, Horizontal Output Transformer (T701), Deflection Yoke (DY1), Choke Coil (L701) and Diodes D707 and D708. Also check Horizontal Size Coil (L702), Horizontal Linearity Coil (L703) and Electrolytics C714, C715 and C716. Check the outputs of Diodes D710, D711 and D712 for possible shorts that could load down the Horizontal Output Transformer. Poor Horizontal Linearity or foldover problems may be caused by Electrolytics C714, C715 and C716, Horizontal Size Coil (L702), Horizontal Linearity Coil (L703) or Deflection Yoke (DY1). If the display is too narrow, check the 11.8V source at Choke Coil L701. If 11.8V source is low, refer to the "Power Supply" section of this Troubleshooting Guide. If 11.8V source is normal, check waveform at base of Horizontal Output Transistor (Q708). If drive waveform at base of Q708 has insufficient amplitude, check Electrolytic C711 and Resistors R718 and R719. Also check Transistors Q705, Q706 and Q707 for possible leakage.

### VERTICAL

If there is no vertical sweep, check waveform at pin 6 of Vertical Deflection IC (IC601). If vertical sweep signal is present at pin 6 of IC601, check Electrolytic C610, Deflection Yoke DY1 and Resistor R614. If vertical sweep is missing at pin 6 of IC601, check Vertical Deflection IC (IC601) and associated components. Poor vertical linearity or foldover may be caused by a defective component in the vertical feedback circuit. Check Resistors R607, R609, R610, R611, R612 and R613; Capacitors C604, C605, C606 and C607;

Electrolytic C608 and Control VR603. If vertical sweep is off frequency, check Vertical Hold Control (VR601), Resistor R605 and Capacitor C603. If the components in the Vertical Hold circuit check good, check Vertical Deflection IC (IC601) by substitution.

### SYNC

If there is no vertical sync, check waveform at pin 10 of Vertical Deflection IC (IC610). If the signal is missing at pin 10 of IC601, check Electrolytic C601, Resistor R603, Diode D601 and Capacitor C602. If waveform is present at pin 6 of IC601, check IC601 by substitution. If there is no horizontal sync, check waveform at base of Horiz Sync Transistor (Q701). If waveform is missing at base of Q701, check IC302, Resistor R704 and Capacitor C704. If waveform is present at the base of Q701, check Q701, Resistor R705 and Diodes D701 and D702.

### VIDEO

No video. Check waveform at Collector of Video Output Transistor (Q303). If waveform is present at collector of Q303, check Resistor R312. If R312 is good, check voltages on pins 1, 2, 3, 4 and 5 of the CRT. If the CRT voltages are normal, check the CRT. Also make sure that the CRT socket is making good contact with the CRT pins, especially pins 2 and 3. If waveform is missing at collector of Q303, check waveform at base of Video Drive Transistor (Q302). If waveform is present at base of Q302, check Transistors Q302 and Q303; Resistors R302, R310, R311 and R313; Choke Coil L301; Electrolytic C307 and Capacitor C313. Also check Diode D711 and Electrolytics C718 and C308. If waveform is missing at base of Q302, check waveform at base of Video Amp Transistor (Q304). If video waveform is present at base of Q304, check Transistors Q304 and Q301, IC302, Resistors R304 and R308, Electrolytics C304 and C305, Contrast Control (VR302) and Brightness Control (VR301).

If brightness is excessive, check Resistor R305. Also check Transistors Q301 and Q302 for leakage. If Contrast Control has no effect on the display, check Resistor R307. If the display is dim, check Resistors R723 and R728, Sub-Brightness Control (VR702) and Capacitor C720.

### SOUND

No sound. Type in and run the following Basic program:

10 SOUND 1,12,12,4,50

With the above program running, check for a sound signal at pin 8 of Audio Processor IC (IC401). If sound signal is present at pin 8 of IC401, check for sound signal at pin 1 of Connector P401. If sound signal is present at pin 1 of P401, check the speaker. If sound signal is missing at pin 1 of P401, check Electrolytic C408. If sound signal is missing at pin 8 of IC401, check for sound signal at pin 2 of IC401. If sound signal is present at pin 2 of IC401, check IC401 and associated components. If sound signal is missing at pin 2 of IC401, check Electrolytic C401 and Resistor R401. Also check Connector P301 for good connections.

## MISCELLANEOUS ADJUSTMENTS

### INITIAL MONITOR TEST

Connect Computer to Monitor and turn both On. When the initial instructions pertaining to the Disk Drive appear on the Monitor screen, adjust the Brightness and Contrast controls for best display. Check the operation of the Vertical Hold, Vertical Height, Vertical Linarity, Horizontal Centering and Focus controls. If the operation of any control is erratic, clean that control with contact cleaner and recheck.

### FOCUS ADJUSTMENT

Adjust Focus Control (VR703) for a sharp, well defined display.

### VERTICAL HOLD ADJUSTMENT

Adjust Vertical Hold Control (VR601) for the most stable display.

### VERTICAL SIZE ADJUSTMENT

Adjust Vertical Size Control (VR602) for the desired vertical size of the display.

### VERTICAL LINEARITY ADJUSTMENT

Adjust Vertical Linearity Control (VR603) for even vertical spacing of the display.

### HORIZONTAL CENTERING ADJUSTMENT

Adjust Horizontal Centering Control (VR701) to center the display horizontally.

### HORIZONTAL SIZE ADJUSTMENT

Adjust Horizontal Size Coil (L702) for desired width of the display.

### HORIZONTAL LINEARITY ADJUSTMENT

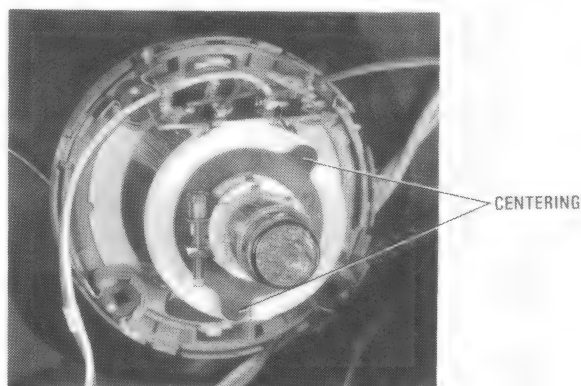
Adjust Horizontal Linearity Coil (L703) for even horizontal spacing of the display.

### CENTERING ADJUSTMENT

Center the display on the screen by adjusting the two magnetic centering rings located on the rear cover of the deflection yoke.

### SUB BRIGHTNESS ADJUSTMENT

Set the Brightness and Contrast Controls to maximum clockwise position. Adjust Sub Brightness Control (VR702) for maximum brightness without retrace lines.



CRT NECK ASSEMBLY

CSCS12-B

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## DISASSEMBLY INSTRUCTIONS

### CABINET REMOVAL

Remove five Phillips screws on rear of cabinet. Slide cabinet enclosure back far enough to disconnect speaker plug. Remove cabinet enclosure.

### CHASSIS REMOVAL

Remove two Phillips screws underneath chassis that mount chassis to cabinet front. Remove Phillips screw at top of control mounting bracket. Disconnect CRT socket, HV anode lead, Deflection Yoke leads and Indicator LED leads.

Disconnect ground lead in front of Horizontal Output Transformer. Work mounting tabs on bottom of chassis loose from cabinet assembly and remove chassis.

### CRT REMOVAL

Follow "Cabinet Removal" and "Chassis Removal" procedures. Lay Monitor face down on a soft protective surface. Remove Deflection Yoke from neck of CRT. Remove four screws holding CRT to cabinet front and lift CRT from cabinet. DO NOT Lift CRT by the Neck.

## ∞ PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

### SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			NOTES	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
D601 D602 D701 thru D705	GP10D			NTE519 NTE116 NTE519	ECG519 ECG116 ECG519	SK3100/519 SK3311 SK3100/519	WEP925/519 WEP156 WEP925/519	103-131 212-76-02 103-131
D706 D707	GP10G GP30JG			NTE116 NTE5806	ECG116 ECG5806	SK3312 SK3848/5806	WEP157 WEP4006/5806	212-76-02 212-Z9000
D708 D709 D710 D711 D712	RGP10G RGP10D GP10D RGP10D			NTE552 NTE552 NTE552 NTE552 NTE552	ECG552 ECG552 ECG552 ECG552 ECG552	SK9000/552 SK5014 SK9000/552 SK5014 SK9000/552	WEP172/506 WEP172/506 WEP172/506 WEP172/506 WEP172/506	103-287 103-287 103-287 103-287 103-287
D901 thru D904 IC301 IC302 IC401	1N5402  GL7805 SN7406N AN5265			NTE5802  NTE960 NTE7406	ECG5802  ECG960 ECG7406	SK9005/5802  SK3591/960 SK7406	WEP4002/5802	212-Z9000  221-Z9043 HE-443-698
IC601 IC901 Q301 Q302 Q303	TDA1170D MC78T12CT (KT)C1959-0 BSX20 (KT)C2229-0			NTE966 NTE85 NTE311 NTE399	ECG966 ECG85 ECG311 ECG399	SK3592/966 SK9229/85 SK3195/311 SK9352/399	WEP966L/966 WEP910/289 WEP969/311 WEP68/287*	HE-442-674 921-1114 121-Z9070 121-Z9045*
Q304 Q701 Q702 thru Q707 Q708 Q901	BSX20 (KT)A562-0 (KT)C1959-0  BU806 (KT)A473-0			NTE311 NTE290A NTE85  NTE2315	ECG311 ECG290A ECG85  ECG2315 ECG153	SK3195/311 SK3114A/290A SK9229/85  SK3274/153	WEP969/311 WEP911/290A WEP910/289  WEP746/153	121-Z9070 121-Z9003* 921-1114  121-988-03

## PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R307	4300 2% 1/4W Carbon Film		QW243	
R313	680 5% 3W Wire Wound			
R603	270 2% 1/4W Carbon Film		QW127	
R706	1200 2% 1/4W Carbon Film		QW212	
R707	10K 2% 1/4W Carbon Film		QW310	
R708	18K 2% 1/4W Carbon Film		QW318	
R709	1200 2% 1/4W Carbon Film		QW212	
R711	1200 2% 1/4W Carbon Film		QW212	
R712	15K 2% 1/4W Carbon Film		QW315	
R713	22K 2% 1/4W Carbon Film		QW322	
R715	1200 2% 1/4W Carbon Film		QW212	
TH701	560 Cold NTC Thermistor			

### CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
VR301	Brightness	500	56Z071G500E (1)	
VR302	Contrast	500	56Z071G500E (1)	
VR401	Volume (2)	10K	56Z-021A-10KB (1)	
VR601	Vertical Hold	220K	552Z-220KB (1)	
VR602	Vertical Size	220K	552Z-220KB (1)	
VR603	Vertical Linearity	100K	552Z-100KB (1)	
VR701	Horizontal Centering	10K	532Z-10KB (1)	
VR702	Sub Brightness	100K	552Z-100KB (1)	
VR703	Focus	3.3M	55Z-094A-3.3MB (1)	

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(1) Number on unit.

(2) Includes SW901, Power Switch, numbers on unit TV-3, 5J1A1130.

### COILS & TRANSFORMERS (Sweep Circuits)

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
DY1	Yoke			
L301	Choke			
L302	Peaking			
L701	Choke			
L702	Horizontal Size			
L703	Horizontal Linearity			
T1	Power			
T701	Horizontal Output			

## PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

### FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F901 F903	750mA @ 250V Fast-Acting 2A @ 125V Fast-Acting			

### SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA		NOTES
		MFGR. PART No.	QUAM PART No.	
SP1	3" PM, 8 Ohms	080A21GB (1)	30A05Z8	(1) Number on unit.

### MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
LED901 SW901 SG301 SG702 SG703 V1	LED Switch Spark Gap Spark Gap Spark Gap CRT	310KAB4K	Power, Grn Power

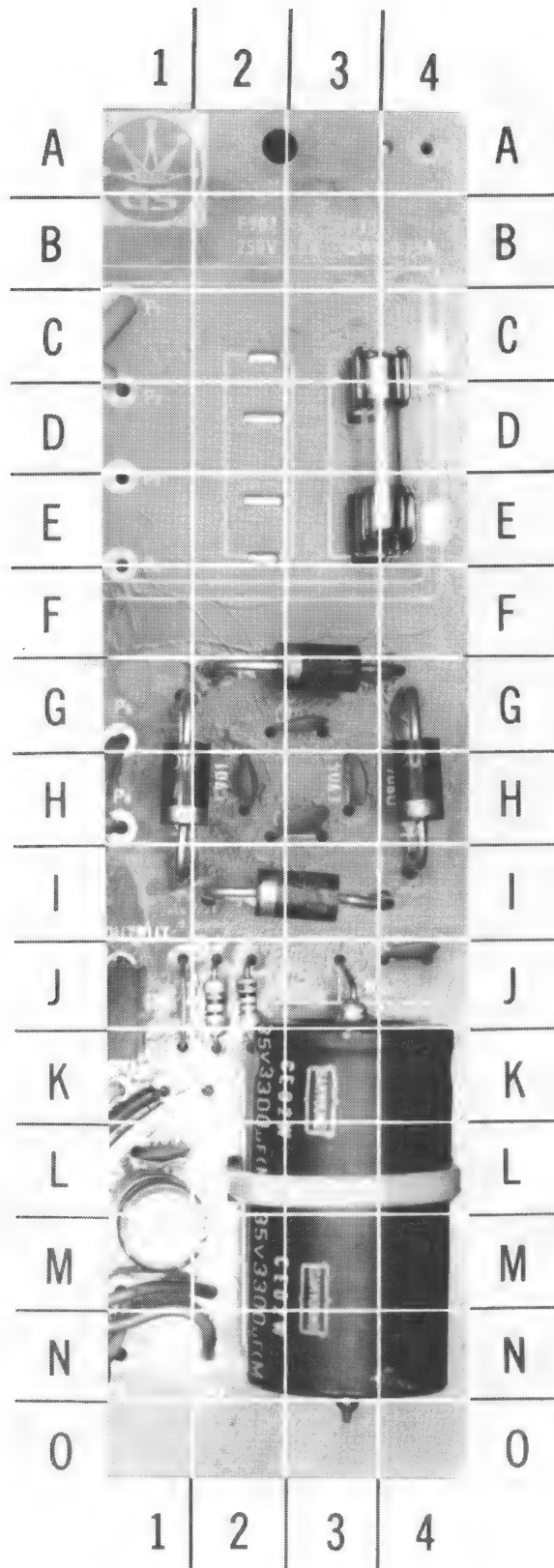
### WIRING DATA

High Voltage Lead .....	Use BELDEN No. 8869 (17 KV) or 8868 (24 KV)
Shielded Hook-up Wire .....	Use BELDEN No. 8401 or 8421 (Single-Conductor) 8208 (Two-Conductor)
General-use Unshielded Hook-up Wire .....	Use BELDEN No. 8529 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors

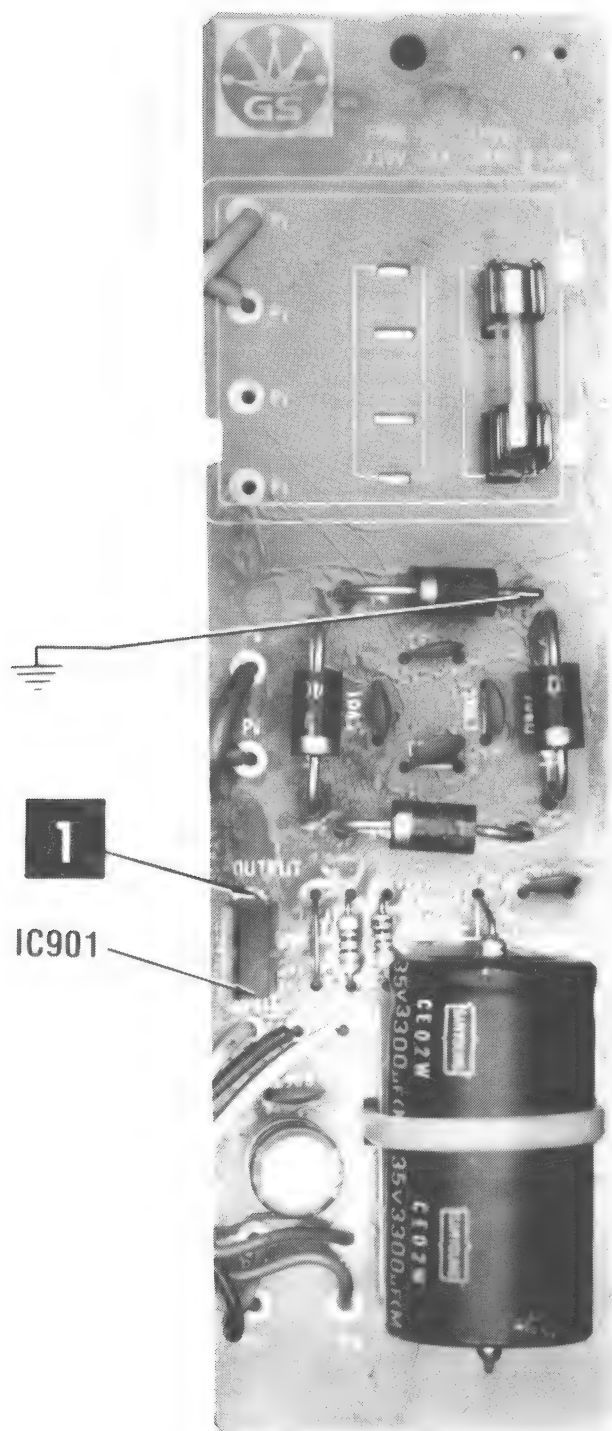


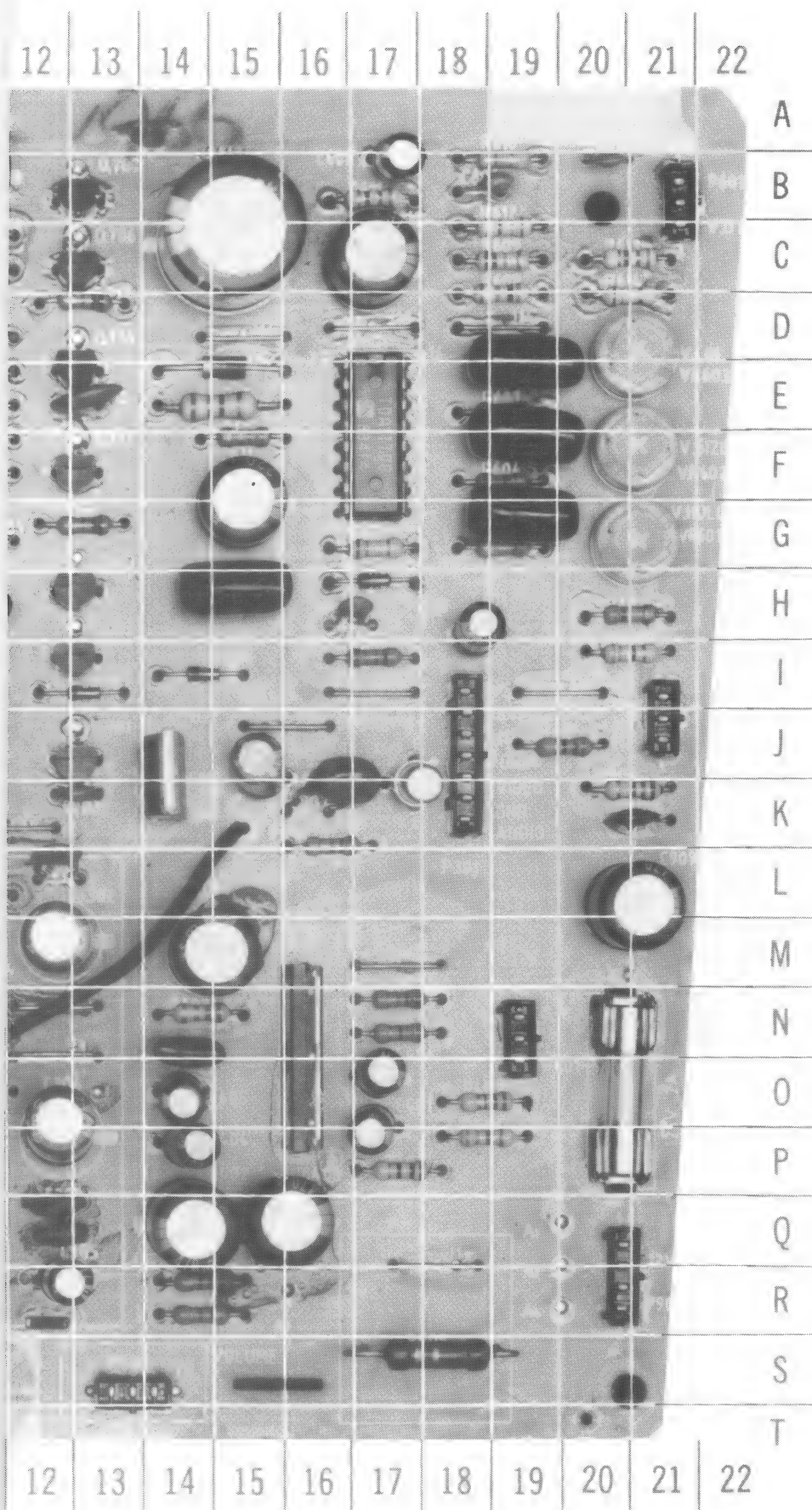
# GridTrace LOCATION GUIDE

C901	H-2
C902	H-3
C903	G-3
C904	H-3
C905	L-3
C906	J-4
C907	H-1
C908	L-1
D901	H-1
D902	I-3
D903	G-3
D904	H-4
F901	D-4
IC901	J-1
R902	J-2
R903	J-2

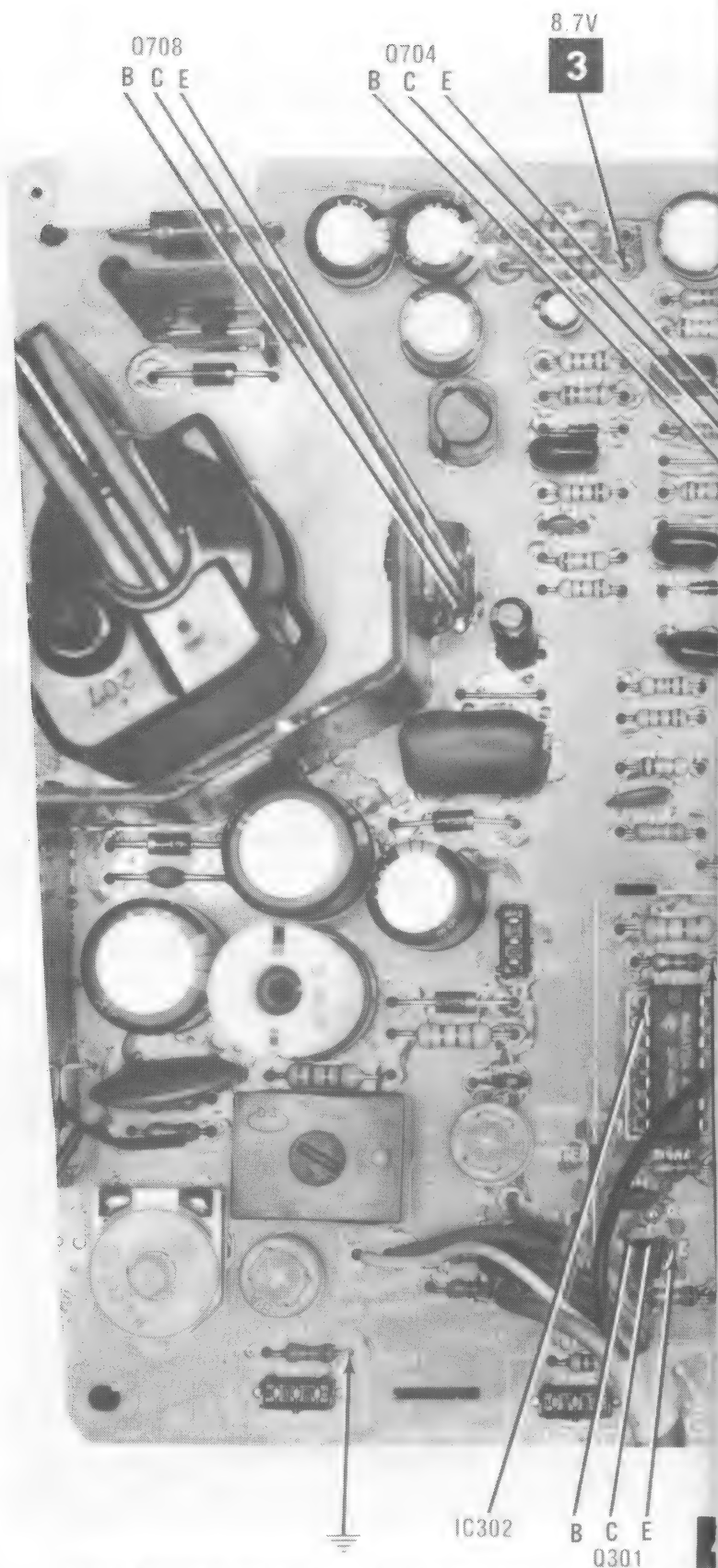


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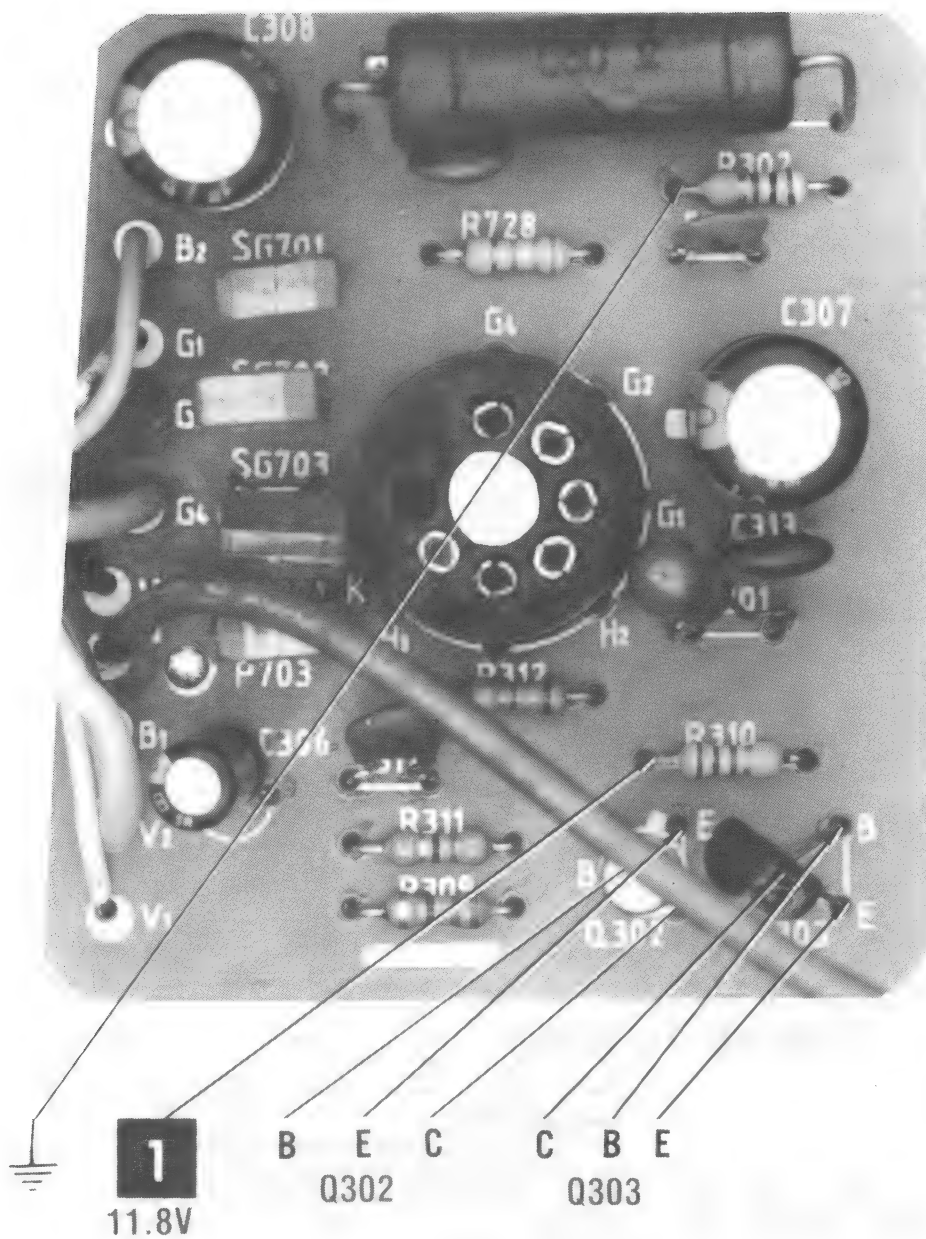
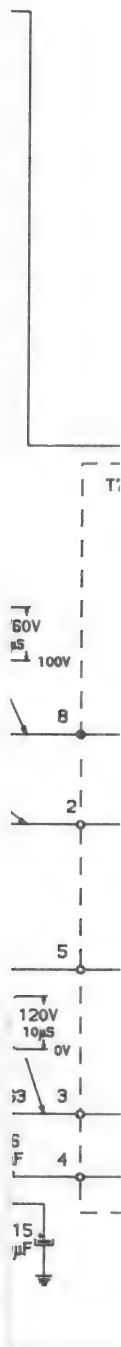




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MODEL 520ST



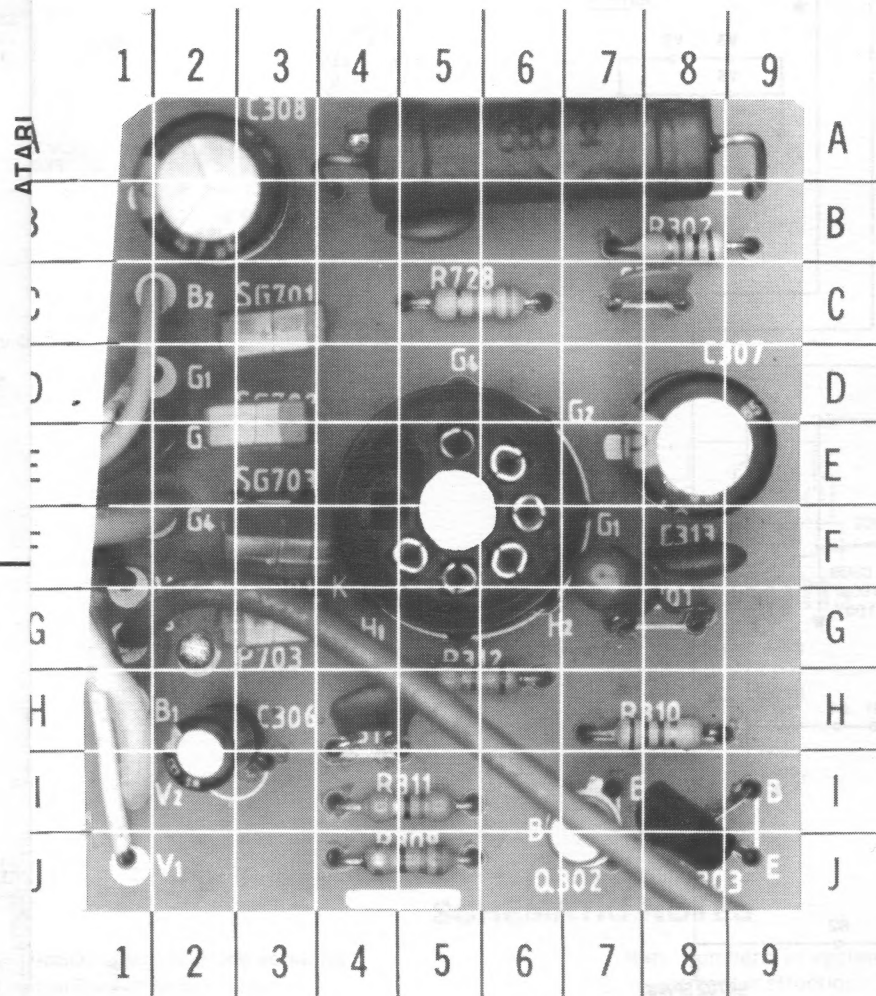
NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED



CRT BOARD

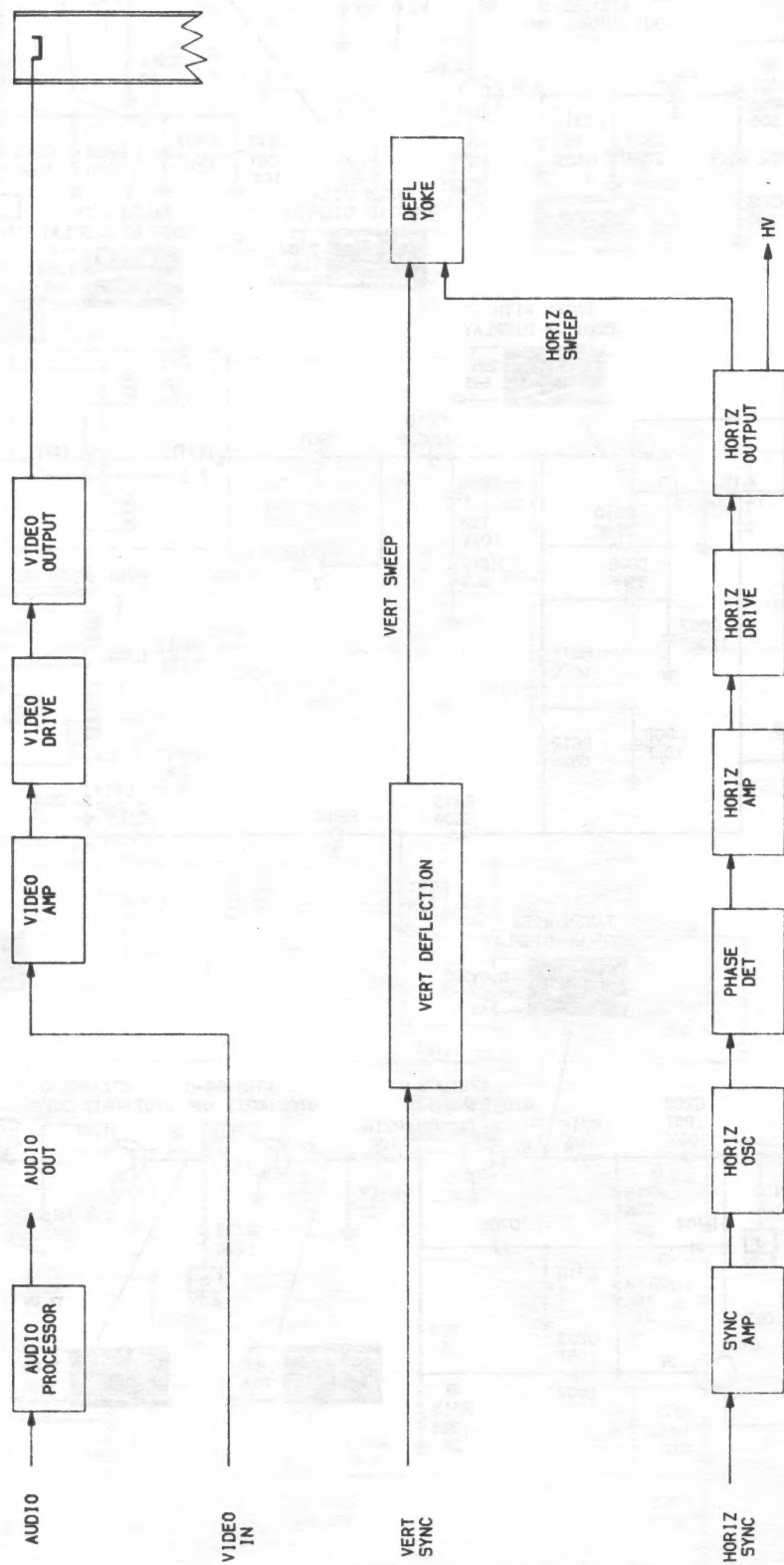


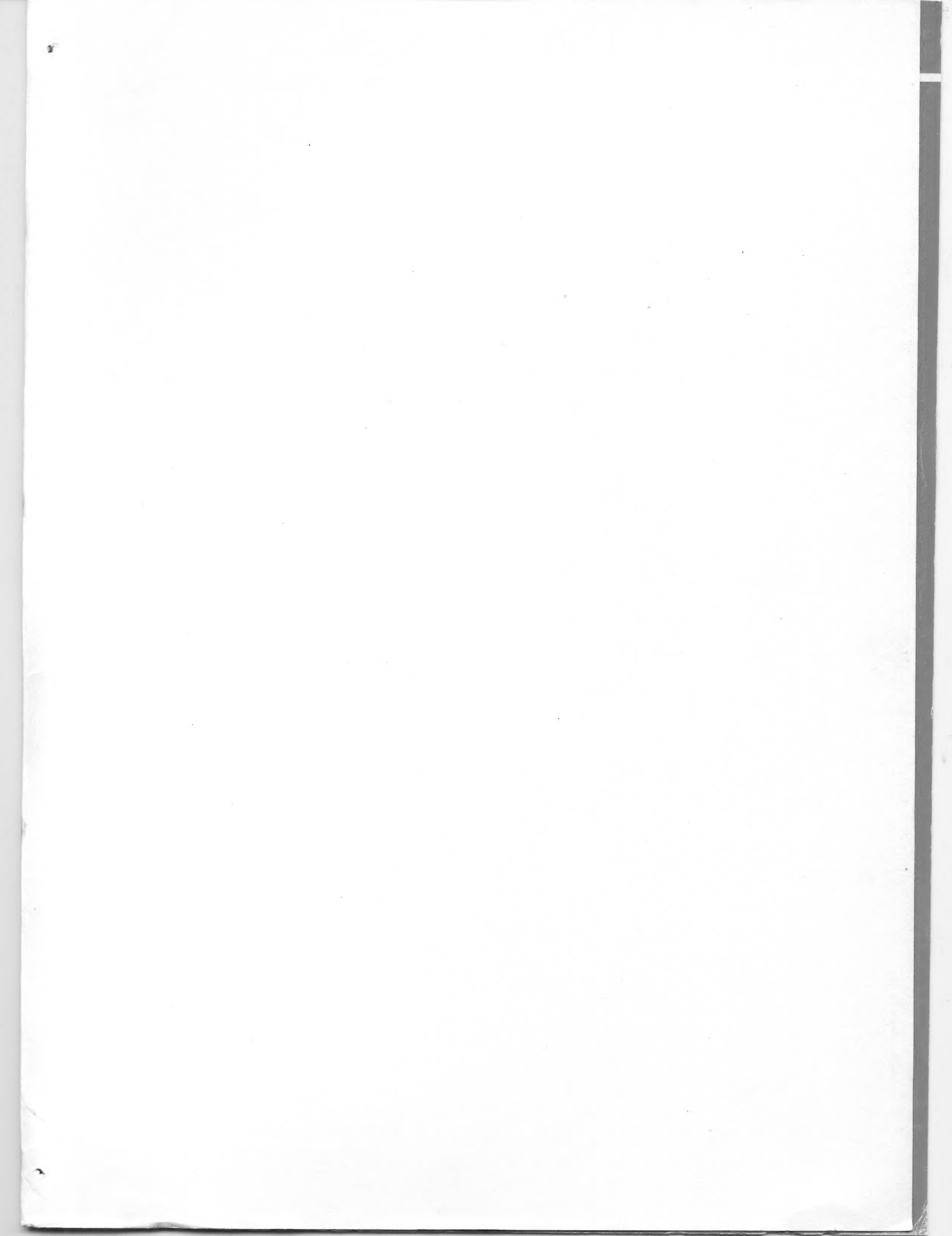
ATARI



# GridTrace LOCATION GUIDE

C306	H-2
C307	E-8
C308	B-2
C312	H-4
C313	F-8
C314	B-5
C720	C-8
L301	F-7
Q302	J-7
Q303	J-8
R302	B-8
R310	H-8
R311	I-5
R312	H-5
R313	A-6
R728	C-5
SG301	G-3
SG701	C-3
SG702	E-3
SG703	F-3

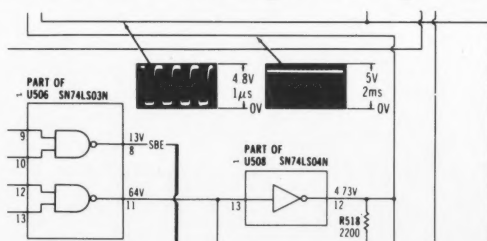




Remove staples and use cover for file folder.

The following information is just a sample of the many valuable time saving features contained in this exclusive Sams **COMPUTERFACTS** publication:

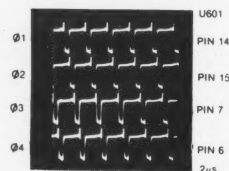
- Preliminary Service Checks section is an easy to use, step by step guide for the experienced technician or hobbyist, and even beginners.
- SAMS famous industry accepted standardized notation schematics containing CIRCUITRACE®. GRIDTRACE™, waveforms, voltages and stage identification.



- Step by Step Troubleshooting guides the technician through the necessary procedures to quickly locate the problem.

#### MICROPROCESSOR CHIP (CPU) OPERATION

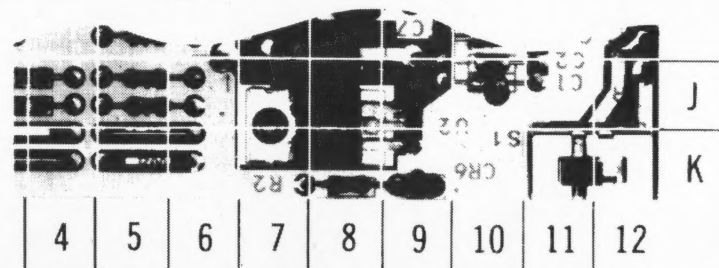
Verify the processor is functioning by checking the signals on the address lines (pins 10 thru 24 of IC U600) and the data lines (pins 41 thru 56) using a logic probe or a scope. If a logic probe is used, refer to the "Logic Chart" for the correct readings. If a scope is used, the waveforms on the address lines (except pins 22 and 23 which have no signal in Power Up mode) should be similar to Figure 1. The waveforms on the data lines should be similar to Figure 2.



- Logic Chart containing logic probe readings to isolate defective circuitry and components.

[illegible]

- Quick Component Location using the SAMS exclusive GRIDTRACE, CIRCUITRACE, and component photographs.



- Complete Components Parts List in an easy to use format with field replacements shown when possible. SAMS unique semiconductor, chip and IC cross-reference gives you many replacements to choose from and is available at your Electronic Distributor.

**SEMICONDUCTORS** (Select replacement for best results)

ITEM No.	TYPE No.	MFRG. PART No.	REPLACEMENT DATA						
			ECG PART No.	GENERAL ELECTRIC PART No.	MOTOROLA PART No.	NTE PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
D102	1SS53	1149-2576	ECG519	GE-514	1N4935	NTE519	SK9091/177	WEP925/519	103-131
D103	1N60FM	1149-2527	ECG109	1N60		NTE109	SK308B	WEP134/109	103-29001
D201	1N4004GP	1201-4205	ECG116	GE-504A	1N4004	NTE116	SK3312	WEP157	212-76-02
D501 thru D503	1SS53	1149-2576	ECG519	GE-514	1N4935	NTE519	SK9091/177	WEP925/519	103-131

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